Final

Site Investigation Report
Fill Area West of Range 19, Parcel 233(7)

Fort McClellan
Calhoun County, Alabama

Prepared for:

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Task Order CK09
Contract No. DACA21-96-D-0018
Shaw Project No. 796886

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Executive Summary

In accordance with Contract Number DACA21-96-D-0018, Task Order CK09, Shaw Environmental, Inc. (Shaw) completed a site investigation (SI) at the Fill Area West of Range 19, Parcel 233(7), at Fort McClellan (FTMC) in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site as a result of historical mission-related Army activities. The SI consisted of the collection and analysis of six surface soil samples, one depositional soil sample, six subsurface soil samples, and one groundwater sample. Four monitoring wells were installed at the site to facilitate groundwater sample collection and to provide site-specific geological and hydrogeological characterization information. However, only one well produced sufficient groundwater for sampling during the investigation. In addition, a geophysical survey and subsequent trenching were performed on the fill area. An assessment of potential wetlands was also conducted at the fill area.

The geophysical survey identified one area of high conductivity readings. However, exploratory trenching did not indicate the presence of fill material below the ground surface. Additionally, the wetlands study determined that wetlands do not exist on or within 200 feet of Parcel 233(7).

Chemical analysis of samples collected at the site indicates that metals, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), and pesticides were detected in site media. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health site-specific screening levels (SSSL), ecological screening values (ESV), and background screening values for FTMC. In addition, site metals data were evaluated using statistical and geochemical methods to determine if the metals detected in site media were naturally occurring.

Three metals in soil (barium, iron, and manganese) and two metals in groundwater (chromium and nickel) were detected at concentrations exceeding SSSLs and background (where available) and, thus, were selected as chemicals of potential concern (COPC). The statistical and geochemical evaluations determined that these metals were naturally occurring except for chromium and nickel in groundwater. To address the presence of chromium and nickel in groundwater, groundwater data were evaluated from four additional wells that surround the site. The data from the surrounding wells indicated that chromium was not detected in any of the wells and nickel was detected in only one upgradient well (800 feet away) at a level below the SSSL. Therefore, the chromium and nickel detected in groundwater at Parcel 233(7) appear to

be isolated occurrences, and are not believed to pose an unacceptable threat to human health. In addition, the pesticide aldrin was identified as a COPC in groundwater because it was detected at an estimated concentration exceeding its SSSL. A streamlined risk assessment (SRA) was completed as a part of an engineering evaluation/cost analysis (EE/CA) for Parcel 233(7). The SRA concluded that the risk associated with aldrin in groundwater was within acceptable limits.

Four metals (barium, beryllium, cobalt, and manganese) were detected in surface soil at concentrations exceeding ESVs and background and, thus, were selected as constituents of potential ecological concern (COPEC). However, the statistical and geochemical evaluation determined that these metals were all naturally occurring. The VOC acetone was also identified as a COPEC because it minimally exceeded its ESV in one surface soil sample. Based on the relatively small amount by which the acetone result exceeded the ESV, coupled with the destruction of a significant portion of the terrestrial habitat at the site resulting from construction of the Eastern Bypass Highway, it is concluded that acetone does not pose an unacceptable threat to ecological receptors at this site. This conclusion is consistent with the findings of a screening-level ecological risk assessment completed as part of the EE/CA.

Based on the results of the SI, including confirmation that fill material is not present, potential historical activities at the Fill Area West of Range 19, Parcel 223(7) have not adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health or the environment. Therefore, Shaw recommends "No Further Action" and unrestricted land reuse with regard to CERCLA-related hazardous substances at the Fill Area West of Range 19, Parcel 233(7).

1.0 Introduction

The U.S. Army has selected Fort McClellan (FTMC) located in Calhoun County, Alabama, for closure by the Base Realignment and Closure (BRAC) Commission under Public Laws 100-526 and 101-510. The 1990 Base Closure Act, Public Law 101-510, established the process by which U.S. Department of Defense (DOD) installations would be closed or realigned. The BRAC Environmental Restoration Program requires investigation and cleanup of federal properties prior to transfer to the public domain. The U.S. Army is conducting environmental studies of the impact of suspected contaminants at parcels at FTMC under the management of the U.S. Army Corps of Engineers (USACE), Mobile District. The USACE contracted Shaw Environmental, Inc. (Shaw) (formerly IT Corporation [IT]) to perform the site investigation (SI) at the Fill Area West of Range 19, Parcel 233(7), under Contract Number DACA21-96-D-0018, Task Order CK09.

This SI report presents specific information and results compiled from the SI conducted at the Fill Area West of Range 19, Parcel 233(7), including field sampling and analysis, monitoring well installation, well abandonment, fill area definition activities (geophysical surveying and trenching), and wetlands assessment. Furthermore, this SI report is a consolidation of data previously presented in multiple documents associated with Parcel 233(7). Decisions regarding this site made at BRAC Cleanup Team (BCT) meetings are an integral component to the conclusions and recommendations presented herein.

1.1 Project Description

The Fill Area West of Range 19 was identified as an area to be investigated prior to property transfer. The site was classified as a Category 7 parcel in the *Final Environmental Baseline Survey, Fort McClellan, Alabama* (Environmental Science and Engineering, Inc. [ESE], 1998). Category 7 parcels are areas that have not been evaluated and/or that require further evaluation.

A site-specific work plan, comprised of a field sampling plan (SFSP) and a safety and health plan, was finalized in December 1998 (IT, 1998a). The work plan was prepared to provide technical guidance for SI field activities at the Fill Area West of Range 19, Parcel 233(7). The site-specific work plan was used as an attachment to the installation-wide work plan (IT, 1998b) and the installation-wide sampling and analysis plan (SAP) (IT, 1998c). The SAP includes the installation-wide safety and health plan and quality assurance plan.

SI field activities included the collection and analysis of six surface soil samples, one depositional soil sample, six subsurface soil samples, and one groundwater sample. Four groundwater monitoring wells were also installed at the site. However, only one well produced sufficient groundwater for sampling. The SI was conducted to determine whether potential site-specific chemicals are present at concentrations that pose an unacceptable risk to human health or the environment.

The Site Investigation and Fill Area Definition Report documented the initial investigative activities conducted at Parcel 233(7) in 1998 (IT, 2002a). This was followed by an Engineering Evaluation/Cost Analysis (EE/CA) that summarized the site characterization and provided a streamlined risk assessment (SRA) for human health and a screening-level ecological risk assessment (SLERA) in accordance with CERCLA criteria (IT, 2002b).

The streamlined (limited or qualitative) risk assessment described in EPA guidance for landfills is not identical to the SRA method using site-specific screening levels (SSSL) generally performed for FTMC sites. However, the SRA method lends itself very well to the types of risk assessments prescribed in the landfill guidance. The SRA performed as part of the EE/CA concluded that exposure to soil and groundwater at Parcel 233(7) does not pose a threat to human health (IT, 2002b).

Additionally, the EE/CA presented the results of the SLERA, which evaluated surface soil at Parcel 233(7). The SLERA indicated that the low levels of constituents of potential ecological concern (COPEC) exceeding ecological screening values (ESV) in surface soil would not present significant risks to the ecosystems at the site. This conclusion was primarily based on the inherent conservatism of the evaluation, the absence of aquatic habitat, and the destruction of the terrestrial habitat by the Eastern Bypass Corridor.

1.2 Purpose and Objectives

The SI program was designed to collect data from site media and provide a level of defensible data and information in sufficient detail to determine whether chemical constituents are present at the Fill Area West of Range 19, Parcel 233(7), at concentrations that pose an unacceptable risk to human health or the environment. The SI analytical results were compared to residential SSSLs, ESVs, and background screening values for metals and polynuclear aromatic hydrocarbons (PAH). The SSSLs, ESVs, and PAH background screening values are presented in the *Final Human Health and Ecological Screening Values and PAH Background Summary*

Report (IT, 2000). Background metals screening values are presented in the *Final Background Metals Survey Report, Fort McClellan, Alabama* (Science Applications International Corporation [SAIC], 1998). In addition, site metals data were further evaluated using statistical and geochemical methods to determine if the metals were site related.

Based on the conclusions presented in this SI report, the BCT will select one of the following courses of action for the site: no further action, additional work, or land use restrictions.

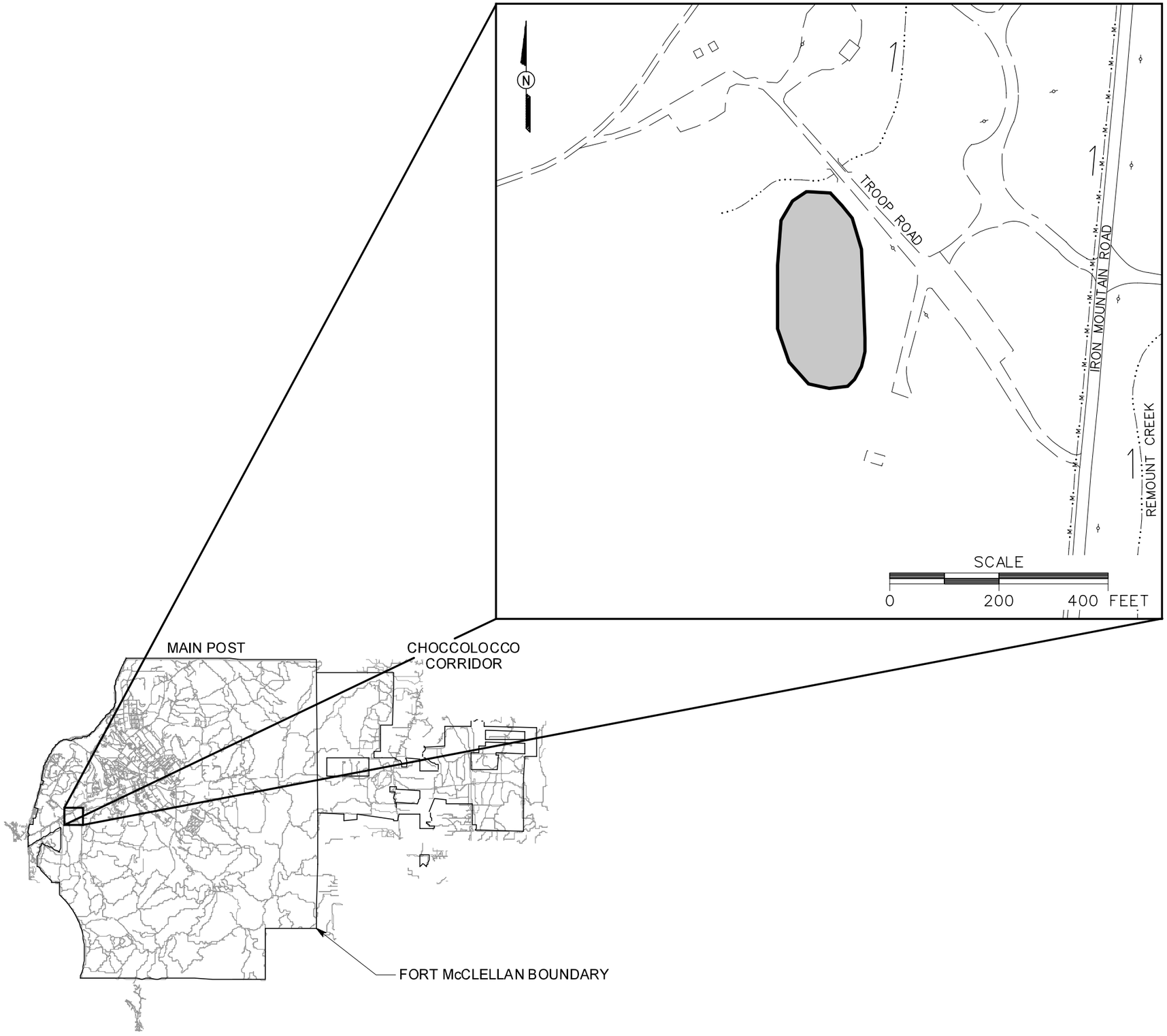
1.3 Site Description and History

The Fill Area West of Range 19, Parcel 233(7), is located in the west-central portion of the FTMC Main Post (Figure 1-1). Parcel 233(7) is an elliptical 1.3-acre area measuring approximately 350 feet long by 150 feet wide (Figure 1-2). Iron Mountain Road and Remount Creek are located approximately 500 feet east of the site. Troop Road is located along the northern and eastern boundary of the parcel and provides access to the site from Iron Mountain Road. Parcel 233(7) ranges in elevation from approximately 820 to 845 feet above mean sea level (amsl) and gently slopes to the north toward a tributary to Remount Creek located along the northern boundary of the site.

Parcel 233(7) was identified as a small "fill area" on a 1949 aerial photograph composite in the Environmental Photographic Interpretation Center report (ESE, 1998). Information was not available regarding the type of material placed at this location.

The *Fort McClellan Archive Search Report, Conclusions and Recommendations, Revision 1* (USACE, 2001a) identified the area near Parcel 233(7) as the former Combat Range No. 2. The Combat Range No. 2 was built during the inter-war period; however, the initial use of this range is unknown. During World War II, the Combat Range No. 2 area was divided into a rocket range, a hand grenade court, and two rifle/grenade ranges. These ranges were closed or abandoned before 1958. According to the archive search report, 2.36-inch rockets (bazookas) were found on the Rocket Range near Area 17 during a site visit. Additionally, the report states that 3.5-inch rockets may have been used on this range. The Fill Area West of Range 19, Parcel 233(7), falls within the "Possible Explosive Ordnance Impact Area" shown on Plate 10 of the *Archive Search Report* (USACE, 2001a).

Operational dates for the Fill Area West of Range 19 could not be determined from the review of available reports. Information on the type of material stored or disposed of at the site is also



LEGEND

- UNIMPROVED ROADS
- PAVED ROADS
- BUILDING
- FORMER BUILDING
- PARCEL BOUNDARY
- SURFACE DRAINAGE / CREEK W/ FLOW DIRECTION
- MANMADE SURFACE DRAINAGE FEATURE W/ FLOW DIRECTION
- UTILITY POLE

FIGURE 1-1
SITE LOCATION MAP
FILL AREA WEST OF RANGE 19
PARCEL 233(7)

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw™ Shaw Environmental, Inc.

DRAWN BY: D. BOMAR | STARTING DATE: 11/25/03 | DATE LAST REV.: | DRAWN BY: | ENGR. CHCK. BY: S. MORAN | DRAFT. CHCK. BY: | PROJ. MGR.: J. YACOUB | INITIATOR: J. REMO | PROJ. NO.: 796886 | DWG. NO.: ...\796886es.184

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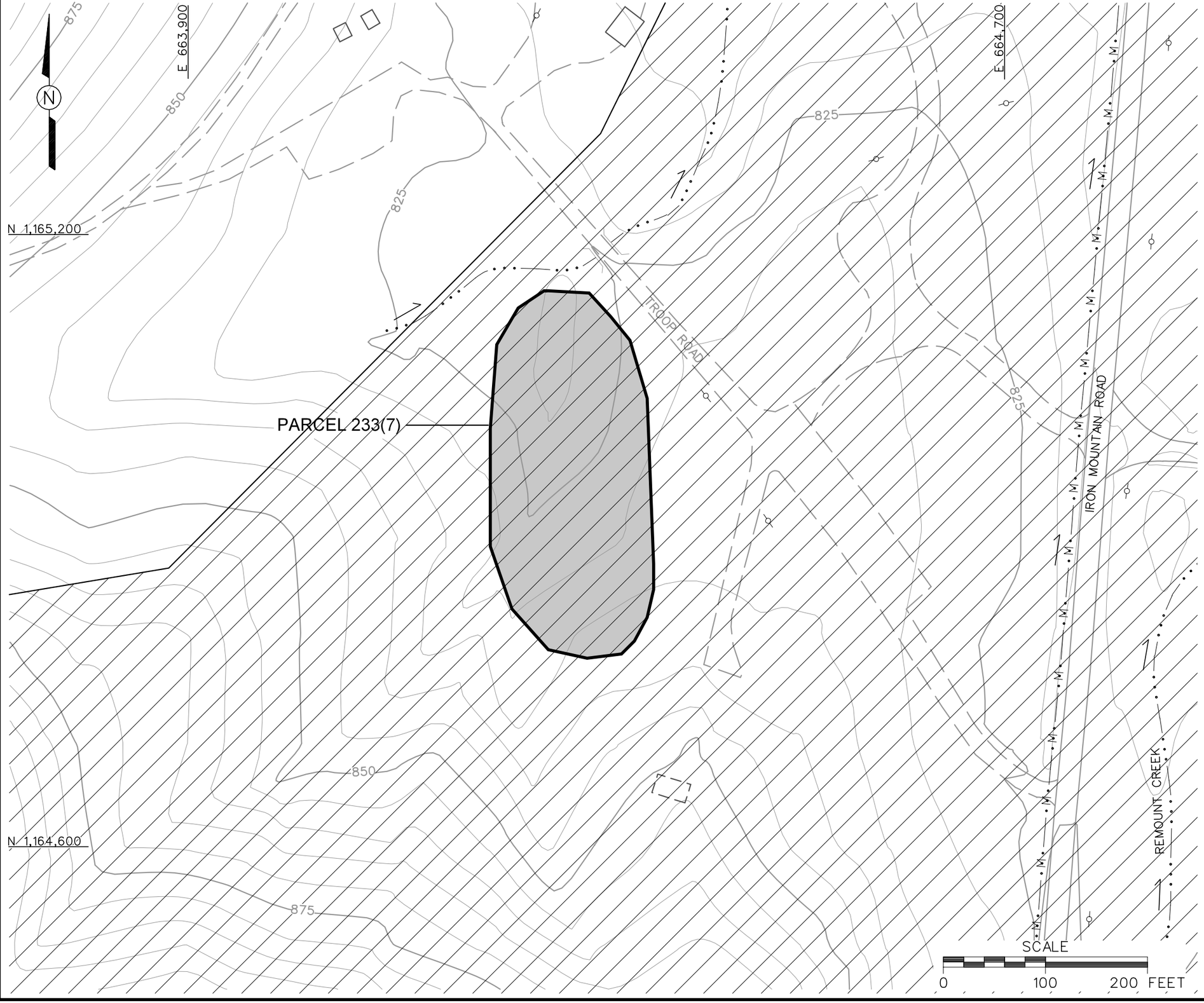

LEGEND

- UNIMPROVED ROADS
- PAVED ROADS
- BUILDING
- FORMER BUILDING
- TOPOGRAPHIC CONTOUR (CONTOUR INTERVAL - 5 FOOT)
- PARCEL BOUNDARY
- SURFACE DRAINAGE / CREEK W/FLOW DIRECTION
- MANMADE SURFACE DRAINAGE FEATURE W/FLOW DIRECTION
- UTILITY POLE
- EASTERN BYPASS CORRIDOR

FIGURE 1-2
SITE MAP
FILL AREA WEST OF RANGE 19
PARCEL 233(7)

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw™ Shaw Environmental, Inc.

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unavailable. Rocks, metal debris, dirt mounds, and partially exposed crushed drums were observed by Shaw during a site visit. The drums were subsequently removed by another contractor as part of Anniston Eastern Bypass construction activities.

Parcel 233(7) and the surrounding area were completely cleared during the summer of 2001 for the Anniston Eastern Bypass Highway. Figure 1-2 shows the bypass corridor.

2.0 Previous Investigations

Prior to the SI conducted by Shaw and the Eastern Bypass clearing activities, an environmental baseline survey (EBS) was conducted by ESE to document the environmental condition of all FTMC property (ESE, 1998). The objective of the study was to identify sites that, based on available information, have no history of contamination and comply with DOD guidance for fast-track cleanup at closing installations. The EBS also provides a baseline picture of FTMC properties by identifying and categorizing the properties by seven criteria:

1. Areas where no storage, release, or disposal of hazardous substances or petroleum products has occurred (including no migration of these substances from adjacent areas).

2. Areas where only release or disposal of petroleum products has occurred.

3. Areas where release, disposal, and/or migration of hazardous substances has occurred, but at concentrations that do not require a removal or remedial response.

4. Areas where release, disposal, and/or migration of hazardous substances has occurred, and all removal or remedial actions to protect human health and the environment have been taken.

5. Areas where release, disposal, and/or migration of hazardous substances has occurred, and removal or remedial actions are underway, but all required remedial actions have not yet been taken.

6. Areas where release, disposal, and/or migration of hazardous substances has occurred, but required actions have not yet been implemented.

7. Areas that are not evaluated or require additional evaluation.

The EBS was conducted in accordance with protocols of the Community Environmental Response Facilitation Act (CERFA) (Public Law 102-426) and DOD policy regarding contamination assessment. Record searches and reviews were performed on all reasonably available documents from FTMC, the Alabama Department of Environmental Management (ADEM), EPA Region 4, and Calhoun County, as well as a database search of substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), petroleum products, and facilities regulated under the Resource Conservation and Recovery Act. Available historical maps and aerial photographs were reviewed to document historical land uses. Personal and telephone interviews of past and present FTMC employees

and military personnel were conducted. In addition, visual site inspections were conducted to verify conditions of specific property parcels. Parcel 233(7) was classified as a CERFA Category 7 parcel in the EBS. Category 7 parcels are areas that have not been evaluated or that require additional evaluation.

3.0 Current Site Investigation Activities

This chapter summarizes SI activities conducted by Shaw at the Fill Area West of Range 19, Parcel 233(7), including unexploded ordnance (UXO) avoidance, environmental sampling and analysis, groundwater monitoring well installation activities, well abandonment, and fill area definition activities.

3.1 UXO Avoidance

UXO avoidance was performed at the Fill Area West of Range 19, Parcel 233(7), following methodology outlined in the SAP. Shaw UXO personnel used a low-sensitivity magnetometer to perform a surface sweep of the parcel prior to site access. After the parcel was cleared for access, sample locations were monitored following procedures outlined in the SAP.

3.2 Fill Area Definition Activities

Shaw performed a geophysical survey and exploratory trenching at Parcel 233(7) to determine the presence or absence of subsurface fill material and, if present, characterize and determine the extent of this material. The geophysical survey area and exploratory trench locations are shown on Figure 3-1.

3.2.1 Geophysical Survey

Shaw conducted a grid-based geophysical survey at Parcel 233(7) to determine the presence or absence of subsurface fill material and, if present, the extent of this material. Shaw used the geophysical survey results to aid in the placement of the exploratory trenches. The geophysical survey was conducted over an approximately 2-acre area encompassing nearly all of Parcel 233(7), as shown on Figure 3-1. A detailed discussion of the geophysical investigation, including theory of instruments operation, field procedures, data processing, and interpreted results, is presented in Appendix A.

The survey was conducted using magnetic and electromagnetic (EM) techniques. The survey grid was established to encompass the suspected disposal site. A detailed site map was drawn in the field identifying any surface features within the survey area or near its perimeter that could potentially affect the geophysical data (e.g., surface metal debris, fencing, and monitoring wells).

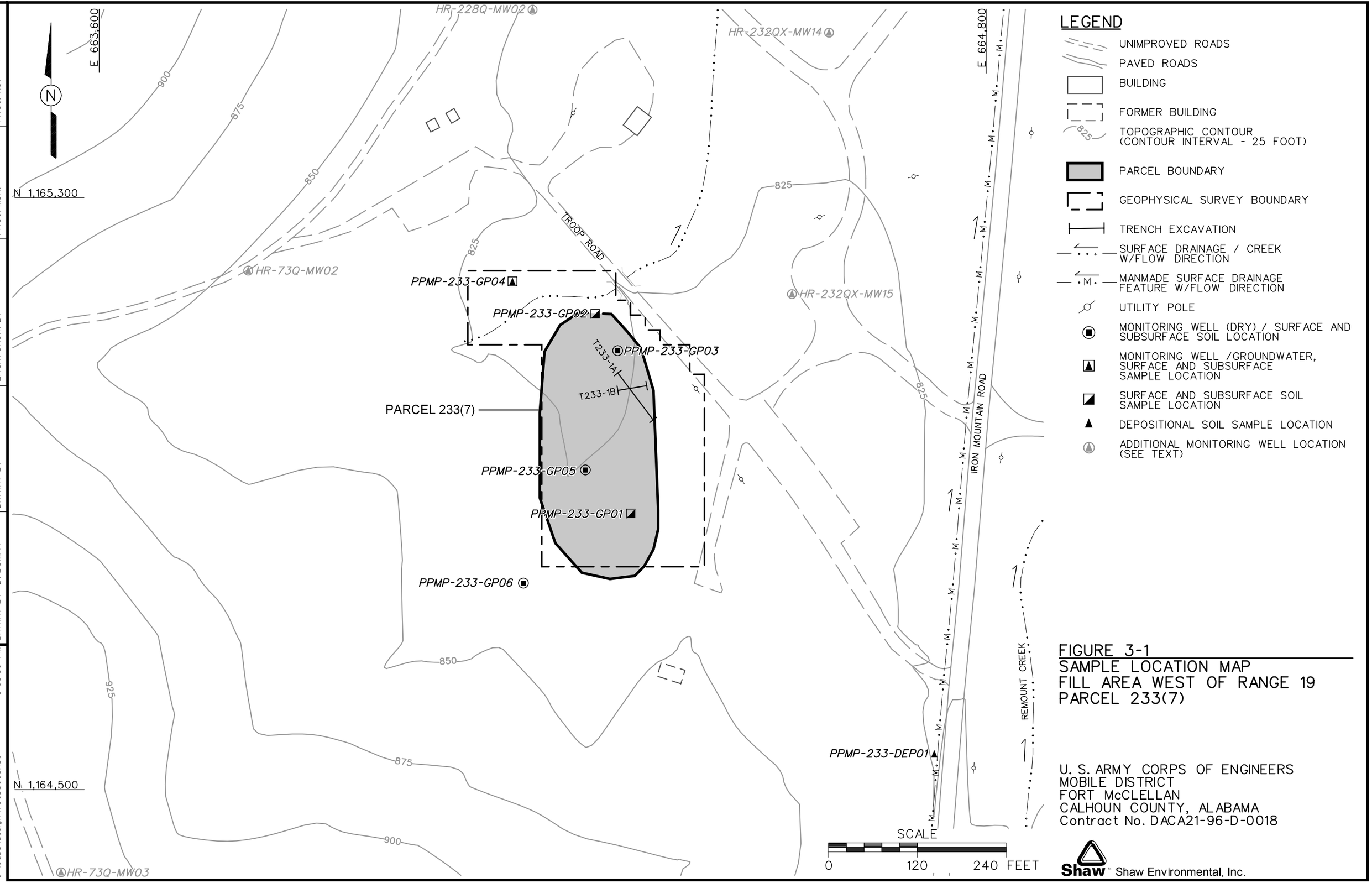

FIGURE 3-1
SAMPLE LOCATION MAP
FILL AREA WEST OF RANGE 19
PARCEL 233(7)

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw™ Shaw Environmental, Inc.

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Preliminary color contour maps of the data were analyzed and compared with the site sketch to differentiate between anomalies caused by surface and subsurface source materials. The geophysical survey results are summarized in Section 4.1.

3.2.2 Trenching

Trenching locations were determined in the field by the site manager based on the geophysical survey results. Prior to trenching, trees and brush were removed to allow access to the trenching locations. Trenching activities were performed in Level C personal protective equipment. The trenches at Parcel 233(7) were excavated using a remote-controlled excavator. Soil and fill materials were stockpiled adjacent to the trench to allow field personnel access for inspection. The on-site geologist recorded the soil lithology and fill material observed in the trenches. Upon completion of inspection of the soil and fill materials, the trenches were backfilled with the excavated material and compacted with the excavator. The trench locations are depicted on Figure 3-1 and the results are summarized in Section 4.2. Appendix B contains the trench logs.

3.3 Environmental Sampling

The environmental sampling performed during the SI at the Fill Area West of Range 19, Parcel 233(7), included the collection of surface and depositional soil samples, subsurface soil samples, and a groundwater sample for chemical analysis. The sample locations were determined by observing site physical characteristics during site reconnaissance and by reviewing historical documents pertaining to activities conducted at the site. The sample locations, media, and rationale are summarized in Table 3-1. Sampling locations are shown on Figure 3-1. Samples were submitted for laboratory analysis of site-related parameters listed in Section 3.5.

3.3.1 Surface and Depositional Soil Sampling

Six surface soil samples and one depositional soil sample were collected at the Fill Area West of Range 19, Parcel 233(7), as shown on Figure 3-1. Soil sampling locations and rationale are presented in Table 3-1. Sample designations and analytical parameters are listed in Table 3-2. Sample locations were determined in the field by the on-site geologist based on UXO avoidance activities, sampling rationale, presence of surface structures, and site topography.

Sample Collection. Surface and depositional soil samples were collected from the uppermost foot of soil using a stainless-steel split-spoon or spoon following methodology specified in the SAP. Prior to collecting the samples, surface material (e.g., rocks and vegetation) was removed from the immediate sample area. The soil was then collected with the sampling device and screened with a photoionization detector (PID) in accordance with procedures outlined in the

Table 3-1

Sampling Locations and Rationale
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Media	Sampling Location Rationale
PPMP-233-GP01	Surface Soil Subsurface Soil	Surface soil and subsurface soil samples were collected in the southern portion of the parcel to determine if potential site-specific chemicals have impacted the environment.
PPMP-233-GP02	Surface Soil Subsurface Soil	Surface and subsurface soil samples were collected along the northern boundary of the parcel to determine if potential site-specific chemicals have impacted the environment.
PPMP-233-GP03	Surface Soil Subsurface Soil	Surface soil and subsurface soil samples were collected in the northern portion of the parcel to determine if potential site-specific chemicals have impacted the environment.
PPMP-233-GP04	Surface Soil Subsurface Soil Groundwater	Surface soil, subsurface soil, and groundwater samples were collected approximately 85 feet northwest of the parcel to determine if potential site-specific chemicals have impacted the environment.
PPMP-233-GP05	Surface Soil Subsurface Soil	Surface soil and subsurface soil samples were collected in the central portion of the parcel to determine if potential site-specific chemicals have impacted the environment.
PPMP-233-GP06	Surface Soil Subsurface Soil	Surface soil and subsurface soil samples were collected approximately 70 feet southwest of the parcel to determine if potential site-specific chemicals have impacted the environment.
PPMP-233-DEP01	Depositional Soil	A depositional soil sample was collected from a manmade culvert along Iron Mountain Road located southeast of the site to determine if potential site-specific chemicals have impacted the environment.

Table 3-2

Soil Sample Designations and Analytical Parameters
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	Sample Depth (ft bgs)	QA/QC Samples			Analytical Parameters
			Field Duplicates	Field Splits	MS/MSD	
PPMP-233-GP01	PPMP-233-GP01-SS-KZ0001-REG	0-1	PPMP-233-GP01-SS-KZ0002-FD	PPMP-233-GP01-SS-KZ0003-FS		Metals, VOCs, SVOCs, PCBs, Pesticides, Herbicides
	PPMP-233-GP01-DS-KZ0004-REG	10-12				
PPMP-233-GP02	PPMP-233-GP02-SS-KZ0005-REG	0-1			PPMP-233-GP02-SS-KZ0005-MS PPMP-233-GP02-SS-KZ0005-MSD	Metals, VOCs, SVOCs, PCBs, Pesticides, Herbicides
	PPMP-233-GP02-DS-KZ0006-REG	10-12				
PPMP-233-GP03	PPMP-233-GP03-SS-KZ0007-REG	0-1				Metals, VOCs, SVOCs, PCBs, Pesticides, Herbicides
	PPMP-233-GP03-DS-KZ0008-REG	10-12				
PPMP-233-GP04	PPMP-233-GP04-SS-KZ0009-REG	0-1				Metals, VOCs, SVOCs, PCBs, Pesticides, Herbicides
	PPMP-233-GP04-DS-KZ0010-REG	10-12				
PPMP-233-GP05	PPMP-233-GP05-SS-KZ0011-REG	0-1				Metals, VOCs, SVOCs, PCBs, Pesticides,
	PPMP-233-GP05-DS-KZ0012-REG	10-12				Herbicides, Explosives[a]
PPMP-233-GP06	PPMP-233-GP06-SS-KZ0013-REG	0-1				Metals, VOCs, SVOCs, PCBs, Pesticides, Herbicides
	PPMP-233-GP03-DS-KZ0014-REG	8-10				
PPMP-233-DEP01	PPMP-233-DEP01-DEP-KZ0015-REG	0-1				Metals, VOCs, SVOCs, PCBs, Pesticides, Herbicides

[a]Subsurface soil sample only.
FD - Field duplicate.
FS - Field split.
ft bgs - Feet below ground surface.
MS/MSD - Matrix spike/matrix spike duplicate.
PCB - Polychlorinated biphenyl.
QA/QC - Quality assurance/quality control.
REG - Regular field sample.
VOC - Volatile organic compound.
SVOC - Semivolatile organic compound.

SAP. The soil fraction for volatile organic compound (VOC) analysis was collected directly from the sample device using three EnCore® samplers. The remaining soil was then transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.5. Sample collection logs are included in Appendix C.

3.3.2 Subsurface Soil Sampling

Subsurface soil samples were collected from six soil borings at the Fill Area West of Range 19, Parcel 233(7), as shown on Figure 3-1. Subsurface soil sampling locations and rationale are presented in Table 3-1. Subsurface soil sample designations, depths, and analytical parameters are listed in Table 3-2. Soil boring locations were determined in the field by the on-site geologist based on UXO avoidance activities, the sampling rationale, the presence of surface structures, and site topography.

Sample Collection. Subsurface soil samples were collected from soil borings at depths of 8 to 12 feet below ground surface (bgs) in the unsaturated zone. The soil borings were advanced and soil samples collected using a stainless-steel split-spoon following procedures specified in the SAP. Sample collection logs are included in Appendix C. The samples were analyzed for the parameters listed in Table 3-2 using methods outlined in Section 3.5.

Subsurface soil samples were collected continuously to 12 feet bgs or until split-spoon sampler refusal was encountered. Samples were field screened using a PID to measure volatile organic vapors. The soil sample displaying the highest reading was selected and sent to the laboratory for analysis; however, at those locations where PID readings were below background, the deepest soil sample interval above the saturated zone was submitted for analysis. The soil fraction for VOC analysis was collected directly from the sample device using three EnCore samplers. The remaining sample was then transferred to a clean stainless-steel bowl, homogenized, and placed in the appropriate sample containers. Samples submitted for laboratory analysis are summarized in Table 3-2. The on-site geologist constructed a detailed boring log for each soil boring. The boring logs are included in Appendix D. At the completion of soil sampling, boreholes were abandoned with hydrated bentonite pellets following borehole abandonment procedures summarized in the SAP.

3.3.3 Monitoring Well Installation

Four permanent monitoring wells were installed at the Fill Area West of Range 19, Parcel 233(7), to collect groundwater samples for laboratory analysis. However, only one of the wells

(PPMP-233-GP04) produced sufficient groundwater for sampling. The well/groundwater sample locations are shown on Figure 3-1. Table 3-3 summarizes construction details of the monitoring wells installed at the site. The well construction logs are included in Appendix D.

Shaw contracted Miller Drilling Company to install the wells at locations PPMP-233-GP03 through PPMP-223-GP06 using a combination of hollow-stem auger and air-rotary drilling methods, following procedures outlined in the SAP. An air-rotary drill rig was used in situations where hollow-stem auger refusal was encountered prior to reaching groundwater.

The borehole for each well was advanced with a 4¼-inch inside diameter (ID) hollow-stem auger from ground surface to the first water-bearing zone at the well location. If hollow-stem auger refusal was encountered prior to reaching groundwater or bedrock, air-rotary drilling was used to continue advancement of the borehole. For the first 12 feet, a 2-foot-long, 2-inch ID stainless-steel split-spoon sampler was driven continuously to collect soil for laboratory analysis and for describing lithology. After the first 12 feet, a 2-foot-long, 2-inch ID carbon-steel split-spoon sampler was driven at 5-foot intervals to collect samples for observing and describing lithology. Where split-spoon refusal was encountered, the auger was advanced until the first water-bearing zone was encountered. The on-site geologist logging the auger boreholes at the site continued the detailed lithological log for each borehole from the depth of split-spoon refusal to the bottom of the auger borehole by logging the auger drill cuttings. Air-rotary drill cuttings were described in detail when an air rig was used. The split-spoon samples and drill cuttings were logged to determine lithologic changes and to approximate the depth at which groundwater was encountered during drilling. This information was used to determine the optimal placement of the monitoring well screen interval and to provide site-specific geologic and hydrogeologic information. Soil characteristics were described using the "Burmeister Identification System" described in Hunt (1986) and the Unified Soil Classification System as outlined in American Society for Testing and Materials (ASTM) Method D2488 (ASTM, 2000). The lithological logs are included in Appendix D.

Upon reaching the target depth in each borehole, a 20- or 30-foot length of 2-inch ID, 0.010-inch continuous slot, Schedule 40 polyvinyl chloride (PVC) screen with a PVC end cap (or approximately 2-foot sump) was placed through the auger to the bottom of the borehole. The screen and end cap (or sump) were attached to a 2-inch ID, flush-threaded Schedule 40 PVC riser. A sand pack consisting of Number 1 filter sand (environmentally safe, clean fine sand, sieve size 20 to 40) was tremied around the well screen to approximately 5 feet above the top of

Table 3-3

Monitoring Well Construction Summary
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Monitoring Well	Northing	Easting	Ground Elevation (ft amsl)	TOC Elevation (ft amsl)	Well Depth (ft bgs)	Screen Length (ft)	Screen Interval (ft bgs)
PPMP-233-GP03	1165091.23	664302.44	826.00	828.31	78	20	57.7 - 77.7
PPMP-233-GP04	1165184.79	664160.21	827.06	829.54	79	20	57 - 77
PPMP-233-GP05	1164930.11	664258.95	830.68	833.23	69	30	39 - 69
PPMP-233-GP06	1164777.03	664175.11	841.05	843.51	81.1	20	60.8 - 80.8

Permanent residuum wells installed using hollow-stem auger and/or air-rotary drilling.
All wells constructed of 2-inch inside diameter, Schedule 40, polyvinyl chloride.

Horizontal coordinates referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North America Datum of 1983.
Elevations referenced to the North America Vertical Datum of 1988.

amsl - Above mean sea level.
bgs - Below ground surface.
ft - Feet
TOC- Top of casing.

the well screen. A bentonite seal, consisting of approximately 3 feet of bentonite pellets, was placed immediately on top of the sand pack and hydrated with potable water. If the bentonite seal was installed below the water table surface, the bentonite pellets were allowed to hydrate in the groundwater. Bentonite seal placement and hydration followed procedures outlined in the SAP. Bentonite-cement grout was tremied into the remaining annular space of the well from the top of the bentonite seal to ground surface. A well cap was placed on the PVC riser. A locking protective steel casing was placed around the top of the PVC well casing and a cement pad was constructed around the wellhead.

The wells were developed by surging and pumping with a submersible pump in accordance with methodology outlined in the SAP. The submersible pump used for well development was moved in an up-and-down fashion to encourage any residual well installation materials to enter the well. These materials were then pumped out of the well to reestablish natural hydraulic flow conditions. Development continued until the water turbidity was less than 20 nephelometric turbidity units, until the well was repeatedly pumped dry, or for a maximum of 8 hours. The well development logs are included in Appendix E.

3.3.4 Groundwater Sampling

A groundwater sample was collected from one of the four monitoring wells (PPMP-233-GP04) installed at the Fill Area West of Range 19, Parcel 233(7). The other three wells did not contain sufficient water for sampling. The groundwater sample location is shown on Figure 3-1 and the sampling rationale is listed in Table 3-1. Groundwater sample designations and analytical parameters are listed in Table 3-4.

Sample Collection. The groundwater sample was collected using a submersible pump equipped with Teflon™ tubing following procedures outlined in the SAP. Groundwater was sampled after purging a minimum of three well volumes and after field parameters (temperature, pH, specific conductivity, oxidation-reduction potential, and turbidity) stabilized. Groundwater field parameters were measured using a calibrated water quality meter, as summarized in Table 3-5. Sample collection logs are included in Appendix C. The sample was analyzed for the parameters listed in Table 3-4 using methods outlined in Section 3.5.

3.3.5 Water Level Measurements

The depth to groundwater was measured in PPMP-233-GP04 and in nearby wells at adjacent parcels on June 11, 2001, following procedures outlined in the SAP. Depth to groundwater was measured with an electronic water-level meter. The meter probe and cable were cleaned before

Table 3-4

Groundwater Sample Designations and Analytical Parameters
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Sample Designation	QA/QC Samples	Analytical Parameters
		Field Duplicates	
PPMP-233-GP04	PPMP-233-GP04-GW-KZ3004-REG	PPMP-233-GP04-GW-KZ3002-FD	Metals, VOCs, SVOCs, PCBs, Pesticides, Herbicides

FD- Field duplicate.
PCB - Polychlorinated biphenyl.
QA/QC - Quality assurance/quality control.
SVOC - Semivolatile organic compound.
VOC - Volatile organic compound.

Table 3-5

Groundwater Field Parameters
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location	Date	Conductivity (mS/cm)	DO (mg/L)	ORP (mV)	Temperature (°C)	Turbidity (NTU)	pH (SU)
PPMP-233-GP04	14-Jul-00	0.016	NA	165	18.3	9.7	4.43

°C - Degree Celsius.
DO - Dissolved oxygen.
mg/L - Milligrams per liter.
mS/cm - Millisiemen per centimeter.
mV - Millivolt.
NA - Not available due to equipment malfunction.
NTU - Nephelometric turbidity unit.
ORP - Oxidation-reduction potential.
SU - Standard unit.

use at each well following decontamination methodology presented in the SAP. Measurements were referenced to the top of the PVC well casing, as summarized in Table 3-6.

3.3.6 Monitoring Well Abandonment

The monitoring wells at Parcel 233(7) were abandoned as part of the Eastern Bypass Corridor clearing activities on or prior to September 13, 2002, as outlined in the SAP. Well abandonment forms are included in Appendix D.

3.4 Surveying of Sample Locations

Sample locations were surveyed using global positioning system and conventional civil survey techniques described in the SAP. Horizontal coordinates were referenced to the U.S. State Plane Coordinate System, Alabama East Zone, North American Datum of 1983. Elevations were referenced to the North American Vertical Datum of 1988. Horizontal coordinates and elevations are included in Appendix F.

3.5 Analytical Program

Samples collected during the SI were analyzed for various chemical and physical parameters based on the potential site-specific chemicals and EPA, ADEM, FTMC, and USACE requirements. The samples were analyzed for the following parameters using EPA SW-846 methods, including Update III methods where applicable:

- Target compound list (TCL) VOCs – EPA Method 8260B
- TCL semivolatile organic compounds (SVOC) – EPA Method 8270C
- Target analyte list metals – EPA Method 6010B/7470A/7471A
- Chlorinated pesticides – EPA Method 8081A
- Polychlorinated biphenyls (PCB) – EPA Method 8082
- Organophosphorus pesticides – EPA Method 8141A
- Chlorinated herbicides – EPA Method 8151A
- Nitroaromatic/nitramine explosives – EPA Method 8330 (subsurface soil sample location PPMP-233-GP05 only).

Table 3-6

Groundwater Elevations
Fill Area West of Range 19, Parcel 233(7) and Vicinity
Fort McClellan, Calhoun County, Alabama

Well Location	Date	Depth to Water (ft BTOC)	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Groundwater Elevation (ft amsl)
PPMP-233-GP04	11-Jun-01	41.39	829.54	827.06	788.15
Wells at Adjacent Parcels					
HR-73Q-MW02	11-Jun-01	42.02	850.23	848.22	808.21
HR-73Q-MW03	11-Jun-01	85.41	949.47	947.49	864.06
HR-228Q-MW02	11-Jun-01	42.33	820.86	818.82	778.53
HR-232QX-MW14	11-Jun-01	18.85	822.99	820.97	804.14
HR-232QX-MW15	11-Jun-01	83.24	834.99	832.99	751.75

Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).

amsl - Above mean sea level.
BTOC - Below top of casing.
ft - Feet.

3.6 Sample Preservation, Packaging, and Shipping

Sample preservation, packaging, and shipping followed requirements specified in the SAP. Sample containers, sample volumes, preservatives, and holding times for the analyses required in this SI are listed in the SAP. Sample documentation and chain-of-custody records were completed as specified in the SAP.

Completed analysis request and chain-of-custody records (Appendix C) were included with each shipment of sample coolers to the analytical laboratory. Samples were shipped to Quanterra Environmental Services in Knoxville, Tennessee. Split samples were shipped to the USACE South Atlantic Division Laboratory in Marietta, Georgia.

3.7 Investigation-Derived Waste Management and Disposal

Investigation-derived waste (IDW) was managed and disposed as outlined in the SAP. The IDW generated during the SI at the Fill Area West of Range 19, Parcel 233(7), was segregated as follows:

- Drill cuttings
- Purge water from well development, sampling activities, and decontamination fluids
- Spent well materials and personal protective equipment.

Solid IDW was stored inside the fenced area surrounding Buildings 335 and 336 in lined roll-off bins prior to characterization and final disposal. Solid IDW was characterized using toxicity characteristic leaching procedure analyses. Based on the results, solid IDW generated during the SI was disposed as nonhazardous waste at the Industrial Waste Landfill on the Main Post of FTMC.

Liquid IDW was contained in the 20,000-gallon sump associated with the Building T-338 vehicle washrack. Liquid IDW was characterized by VOC, SVOC, and metals analyses. Based on the analyses, liquid IDW was discharged as nonhazardous waste to the FTMC wastewater treatment plant on the Main Post.

3.8 Variances/Nonconformances

Three variances to the SFSP were recorded during completion of the SI at the Fill Area West of Range 19, Parcel 233(7). The variances are summarized in Table 3-7 and the variance reports are included in Appendix G.

Table 3-7

Variances to the Site-Specific Field Sampling Plan
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Variance to the SFSP	Justification for Variance	Impact to Site Investigation
Only two of the four proposed exploratory trenches were excavated at the site.	Geophysical survey did not indicate substantial buried metal or subsurface disturbance indicative of waste disposal. Hence, a decision was made to install only two intersecting trenches in an area where the geophysical survey indicated the greatest potential of encountering buried fill materials.	None. Fill material was not observed during trenching operations.
Subsurface soil boring FA-233-SB01 was not installed.	The SFSP proposed PPMP-233-GP05 at approximately the same location as FA-233-SB01 with the same analyses.	None.
Groundwater samples were not collected from monitoring wells PPMP-233-GP03, PPMP-233-GP05, or PPMP-233-GP06.	Groundwater was encountered during drilling activities, but during groundwater sampling activities these wells were dry or did not contain sufficient groundwater for sampling. Several attempts were made to collect a groundwater sample from each well, but all attempts were unsuccessful.	All four groundwater monitoring wells were installed on bedrock. However, only one well (PPMP-233-GP04) produced sufficient water. Because fill material is not present (i.e., a source area of contamination does not exist) and because of the reuse of the parcel (Eastern Bypass), it was determined that bedrock monitoring wells were not required. Therefore, the potential impact to the site investigation is determined to be inconsequential.

SFSP - Site-specific field sampling plan.

Nonconformances to the SFSP were not recorded during completion of the SI.

3.9 Data Quality

The field sample analytical data are presented in tabular form in Appendix H. The field samples were collected, documented, handled, analyzed, and reported in a manner consistent with the SI work plan, the FTMC SAP and quality assurance plan, and standard, accepted methods and procedures. Data were reported and evaluated in accordance with Corps of Engineers South Atlantic Savannah Level B criteria (USACE, 2001b) and the stipulated requirements for the generation of definitive data presented in the SAP. Chemical data were reported via hard-copy data packages by the laboratory using Contract Laboratory Program-like forms.

Data Validation. The reported analytical data were validated in accordance with EPA National Functional Guidelines by Level III criteria. The data validation summary report is included in Appendix I. Selected results were rejected or otherwise qualified based on the implementation of accepted data validation procedures and practices. These qualified parameters are highlighted in the report. The validation-assigned qualifiers were added to the ShawView™ database for tracking and reporting. The qualified data were used in the comparisons to the SSSLs and ESVs. Rejected data (assigned an "R" qualifier) were not used in the comparisons to the SSSLs and ESVs. The data presented in this report, except where qualified, meet the principle data quality objective for this SI.

4.0 Site Characterization

This chapter presents the results of the geophysical survey, trenching activities, and wetlands study conducted at the Fill Area West of Range 19, Parcel 233(7), as well as information on regional and site geology, and site hydrology.

4.1 Geophysical Survey Results

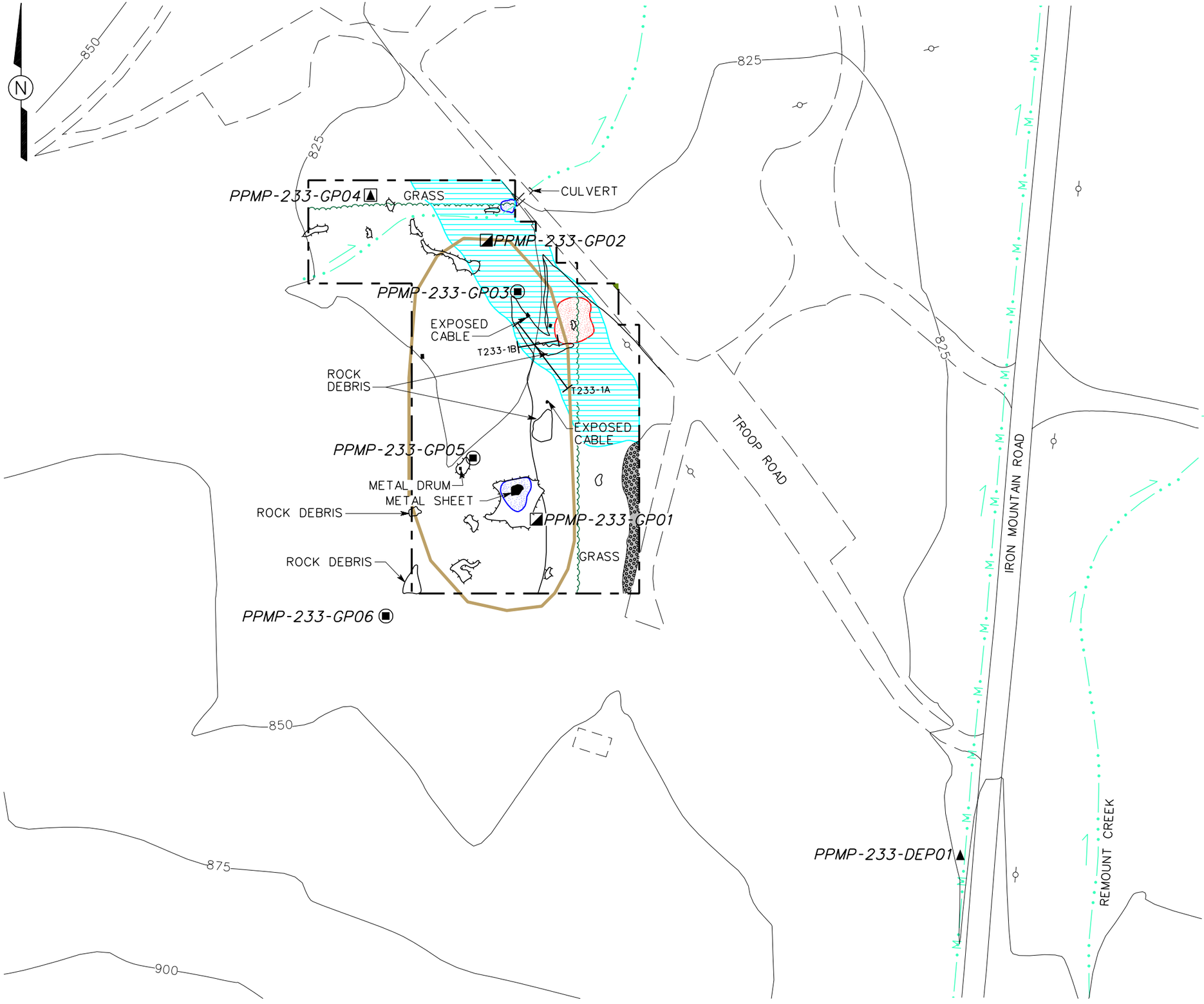
A surface geophysical survey was conducted at Parcel 233(7) using magnetic and EM techniques. The objectives of this survey were to determine the presence or absence of subsurface fill and, if present, delineate the extent of this material. The results of the survey did not reveal the presence of substantial buried metal or subsurface disturbance indicative of significant waste disposal. However, one area of anomalously high conductivity readings was noted in the northeast portion of the site. Possible sources for this anomaly include surface disposal or placement of conductive fill, local increase in the volume of fine-grained sands at the surface associated with construction activities, or an abandoned road grade partially covered with soil. Figure 4-1 is a geophysical interpretation map showing the locations of individual surface metal objects, areas of low to moderate concentrations of surface metals, and the high conductivity anomaly. The anomalies shown on Figure 4-1 correspond to those shown in the magnetic and EM data contour maps presented in the geophysical survey report (Appendix A). A detailed discussion of the data interpretation is included in the geophysical survey report.

4.2 Trenching Results

Exploratory trenching was performed within the area of the high conductivity anomaly in an attempt to determine its source. Trench excavations consisted of one 50-foot-long trench (T233-1A) crossed by a 30-foot-long trench (T233-1B). These trenches were excavated to depths of 3 to 6 feet bgs. Trench logs completed during excavation of the trenches do not indicate the presence of fill material below ground surface. The trench locations are shown on Figure 3-1 and the trench logs are presented in Appendix B.

4.3 Wetland Determination

An assessment of wetlands located within an approximate 200-foot perimeter of Parcel 233(7) was performed in December 2002. Potential wetlands were delineated in accordance with the *Corps of Engineers Wetlands Delineation Manual* (USACE, 1987) to determine the extent of federally regulated jurisdictional wetlands and waters of the United States. The USACE-Mobile District approved the wetland determination for a five-year period on April 2, 2003.



LEGEND

- GEOPHYSICAL SURVEY BOUNDARY
- PARCEL BOUNDARY
- LOW CONCENTRATION OF BURIED METAL
- HIGH CONDUCTIVITY ANOMALY
- LOW CONCENTRATION OF SURFACE AND/ OR PARTIALLY BURIED METAL DEBRIS
- GRAVEL
- SURFACE METAL OBJECT
- TRENCH EXCAVATION
- MOUND
- TOPOGRAPHIC CONTOUR (CONTOUR INTERVAL - 25 FOOT)
- SURFACE DRAINAGE / CREEK W/FLOW DIRECTION
- MANMADE SURFACE DRAINAGE FEATURE W/FLOW DIRECTION
- UTILITY POLE
- MONITORING WELL / SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- MONITORING WELL / GROUNDWATER SURFACE, AND SUBSURFACE SOIL SAMPLE LOCATION
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- DEPOSITIONAL SOIL SAMPLE LOCATION

SCALE

0 100 200 FEET

FIGURE 4-1
GEOPHYSICAL INTERPRETATION MAP FILL AREA WEST OF RANGE 19 PARCEL 233(7)

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw Environmental, Inc.

DRAFT. CHCK. BY:
ENGR. CHCK. BY: S. MORAN
PROJ. MGR.: J. YACOUB
INITIATOR: J. REMO
DWG. NO.: ...\796886es.187
PROJ. NO.: 796886
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 11/26/03
DRAWN BY: D. BOMAR
9/16/2004 10:16:37 AM
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The wetland determination concluded that wetlands or jurisdictional waters of the United States do not exist on or within 200 feet of the parcel (Shaw, 2003a).

4.4 Regional and Site Geology

4.4.1 Regional Geology

Calhoun County includes parts of two physiographic provinces, the Piedmont Upland Province and the Valley and Ridge Province. The Piedmont Upland Province occupies the extreme eastern and southeastern portions of the county and is characterized by metamorphosed sedimentary rocks. The generally accepted range in age of these metamorphics is Cambrian to Devonian.

The majority of Calhoun County, including the Main Post of FTMC, lies within the Appalachian fold-and-thrust structural belt (Valley and Ridge Province), where southeastward-dipping thrust faults with associated minor folding are the predominant structural features. The fold-and-thrust belt consists of Paleozoic sedimentary rocks that have been asymmetrically folded and thrust-faulted, with major structures and faults striking in a northeast-southwest direction.

Northwestward transport of the Paleozoic rock sequence along the thrust faults has resulted in the imbricate stacking of large slabs of rock referred to as thrust sheets. Within an individual thrust sheet, smaller faults may splay off the larger thrust fault, resulting in imbricate stacking of rock units within an individual thrust sheet (Osborne and Szabo, 1984). Geologic contacts in this region generally strike parallel to the faults, and repetition of lithologic units is common in vertical sequences. Geologic formations within the Valley and Ridge Province portion of Calhoun County have been mapped by Warman and Causey (1962), Osborne and Szabo (1984), and Moser and DeJarnette (1992), and vary in age from Lower Cambrian to Pennsylvanian.

The basal unit of the sedimentary sequence in Calhoun County is the Cambrian Chilhowee Group. The Chilhowee Group consists of the Cochran, Nichols, Wilson Ridge, and Weisner Formations (Osborne and Szabo, 1984), but in Calhoun County is either undifferentiated or divided into the Cochran and Nichols Formations and an upper, undifferentiated Wilson Ridge and Weisner Formation. The Cochran is composed of poorly sorted arkosic sandstone and conglomerate with interbeds of greenish gray siltstone and mudstone. Massive to laminated greenish gray and black mudstone makes up the Nichols Formation, with thin interbeds of

siltstone and very fine-grained sandstone (Osborne et al., 1988). These two formations are mapped only in the eastern part of the county.

The Wilson Ridge and Weisner Formations are undifferentiated in Calhoun County and consist of both coarse-grained and fine-grained clastics. The coarse-grained facies appears to dominate the unit and consists primarily of coarse-grained, vitreous quartzite and friable, fine- to coarse-grained, orthoquartzitic sandstone, both of which locally contain conglomerate. The fine-grained facies consists of sandy and micaceous shale and silty, micaceous mudstone, which are locally interbedded with the coarse clastic rocks. The abundance of orthoquartzitic sandstone and quartzite suggests that most of the Chilhowee Group bedrock in the vicinity of FTMC belongs to the Weisner Formation (Osborne and Szabo, 1984).

The Cambrian Shady Dolomite overlies the Weisner Formation northeast, east, and southwest of the Main Post and consists of interlayered bluish gray or pale yellowish gray sandy dolomitic limestone and siliceous dolomite with coarsely crystalline, porous chert (Osborne et al., 1989). A variegated shale and clayey silt have been included within the lower part of the Shady Dolomite (Cloud, 1966). Material similar to this lower shale unit was noted in core holes drilled by the Alabama Geologic Survey on FTMC (Osborne and Szabo, 1984). The character of the Shady Dolomite in the FTMC vicinity and the true assignment of the shale at this stratigraphic interval are still uncertain (Osborne, 1999).

The Rome Formation overlies the Shady Dolomite and locally occurs to the northwest and southeast of the Main Post, as mapped by Warman and Causey (1962) and Osborne and Szabo (1984), and immediately to the west of Reilly Airfield (Osborne and Szabo, 1984). The Rome Formation consists of variegated, thinly interbedded grayish red-purple mudstone, shale, siltstone, and greenish red and light gray sandstone, with locally occurring limestone and dolomite. Weaver Cave, located approximately 1 mile west of the northwest boundary of the Main Post, is situated in gray dolomite and limestone mapped as the Rome Formation (Osborne et al., 1997). The Conasauga Formation overlies the Rome Formation and occurs along anticlinal axes in the northeastern portion of Pelham Range (Warman and Causey, 1962; Osborne and Szabo, 1984) and the northern portion of the Main Post (Osborne et al., 1997). The Conasauga Formation is composed of dark gray, finely to coarsely crystalline, medium- to thick-bedded dolomite with minor shale and chert (Osborne et al., 1989).

Overlying the Conasauga Formation is the Knox Group, which is composed of the Copper Ridge and Chepultepec dolomites of Cambro-Ordovician age. The Knox Group is undifferentiated in Calhoun County and consists of light to medium gray, fine to medium crystalline, variably bedded to laminated, siliceous dolomite and dolomitic limestone that weather to a chert residuum (Osborne and Szabo, 1984). The Knox Group underlies a large portion of the Pelham Range area.

The Ordovician Newala and Little Oak Limestones overlie the Knox Group. The Newala Limestone consists of light to dark gray, micritic, thick-bedded limestone with minor dolomite. The Little Oak Limestone is comprised of dark gray, medium- to thick-bedded, fossiliferous, argillaceous to silty limestone with chert nodules. These limestone units are mapped as undifferentiated at FTMC and in other parts of Calhoun County. The Athens Shale overlies the Ordovician limestone units. The Athens Shale consists of dark gray to black shale and graptolitic shale with localized interbedded dark gray limestone (Osborne et al., 1989). These units occur within an eroded "window" in the uppermost structural thrust sheet at FTMC and underlie much of the developed area of the Main Post.

Other Ordovician-aged bedrock units mapped in Calhoun County include the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation. These units consist of various siltstones, sandstones, shales, dolomites, and limestones and are mapped as one undifferentiated unit in some areas of Calhoun County. The only Silurian-age sedimentary formation mapped in Calhoun County is the Red Mountain Formation. This unit consists of interbedded red sandstone, siltstone, and shale with greenish gray to red silty and sandy limestone.

The Devonian Frog Mountain Sandstone consists of sandstone and quartzitic sandstone with shale interbeds, dolomudstone, and glauconitic limestone (Osborne et al., 1988). This unit occurs locally in the western portion of Pelham Range.

The Mississippian Fort Payne Chert and the Maury Formation overlie the Frog Mountain Sandstone and are composed of dark to light gray limestone with abundant chert nodules and greenish gray to grayish red phosphatic shale, with increasing amounts of calcareous chert toward the upper portion of the formation (Osborne and Szabo, 1984). These units occur in the northwestern portion of Pelham Range. Overlying the Fort Payne Chert is the Floyd Shale, also of Mississippian age, which consists of thin-bedded, fissile brown to black shale with thin

intercalated limestone layers and interbedded sandstone. Osborne and Szabo (1984) reassigned the Floyd Shale, which was mapped by Warman and Causey (1962) on the Main Post of FTMC, to the Ordovician Athens Shale based on fossil data.

The Pennsylvanian Parkwood Formation overlies the Floyd Shale and consists of a medium to dark gray, silty, clay shale and mudstone with interbedded light to medium gray, very fine to fine grained, argillaceous, micaceous sandstone. Locally, the Parkwood Formation also contains beds of medium to dark gray argillaceous, bioclastic to cherty limestone and beds of clayey coal up to a few inches thick (Raymond et al., 1988). The Parkwood Formation in Calhoun County is generally found within a structurally complex area known as the Coosa deformed belt. In the deformed belt, the Parkwood Formation and Floyd Shale are mapped as undifferentiated because their lithologic similarity and significant deformation make it impractical to map the contact (Thomas and Drahovzal, 1974; Osborne et al., 1988). The undifferentiated Parkwood Formation and Floyd Shale are found throughout the western quarter of Pelham Range.

The Jacksonville thrust fault is the most significant structural geologic feature in the vicinity of the Main Post of FTMC, both for its role in determining the stratigraphic relationships in the area and for its contribution to regional water supplies. The trace of the fault extends northeastward for approximately 39 miles between Bynum, Alabama, and Piedmont, Alabama. The fault is interpreted as a major splay of the Pell City fault (Osborne and Szabo, 1984). The Ordovician sequence that makes up the Eden thrust sheet is exposed at FTMC through an eroded window, or fenster, in the overlying thrust sheet. Rocks within the window display complex folding, with the folds being overturned and tight to isoclinal. The carbonates and shales locally exhibit well-developed cleavage (Osborne and Szabo, 1984). The FTMC window is framed on the northwest by the Rome Formation; north by the Conasauga Formation; northeast, east, and southwest by the Shady Dolomite; and southeast and southwest by the Chilhowee Group (Osborne et al., 1997). Two small klippen of the Shady Dolomite, bounded by the Jacksonville fault, have been recognized adjacent to the Pell City fault at the FTMC window (Osborne et al., 1997).

The Pell City fault serves as a fault contact between the bedrock within the FTMC window and the Rome and Conasauga Formations. The trace of the Pell City fault is also exposed approximately nine miles west of the FTMC window on Pelham Range, where it traverses northeast to southwest across the western quarter of Pelham Range. Here, the trace of the Pell City fault marks the boundary between the Pell City thrust sheet and the Coosa deformed belt.

The eastern three quarters of the Pelham Range are located within the Pell City thrust sheet, while the remaining western quarter of Pelham is located within the Coosa deformed belt. The Pell City thrust sheet is a large-scale thrust sheet containing Cambrian and Ordovician rocks and is relatively less structurally complex than the Coosa deformed belt (Thomas and Neathery, 1982). The Pell City thrust sheet is exposed between the traces of the Jacksonville and Pell City faults along the western boundary of the FTMC window and along the trace of the Pell City fault on Pelham Range (Thomas and Neathery, 1982; Osborne et al., 1988). The Coosa deformed belt is a narrow northeast-to-southwest-trending linear zone of complex structure (approximately 5 to 20 miles wide and approximately 90 miles long) consisting mainly of thin imbricate thrust slices. The structure within these imbricate thrust slices is often internally complicated by small-scale folding and additional thrust faults (Thomas and Drahovzal, 1974).

4.4.2 Site Geology

One soil type and one miscellaneous land type are mapped at Parcel 233(7). The Anniston and Allen gravelly loam is mapped across the majority of the parcel with the exception of the southeast corner, which is mapped as the Stony Rough Land sandstone. The Anniston and Allen gravelly loam is developed in old alluvium on the foot slopes and alluvial or colluvial fans at the base of large hills in the region. The surface soil ranges in color from very dark grayish brown to dark reddish gray and dark reddish brown. The subsoil consists of a dark reddish gray and dark reddish brown clay or silty clay loam. The Stony Rough Land sandstone miscellaneous land type is found in rugged areas with steep relief where outcrops of sandstone and quartzite bedrock are common. The soil material consists of a thin veneer of loose rock fragments and scattered patches of sandy soil (U.S. Department of Agriculture [USDA], 1961).

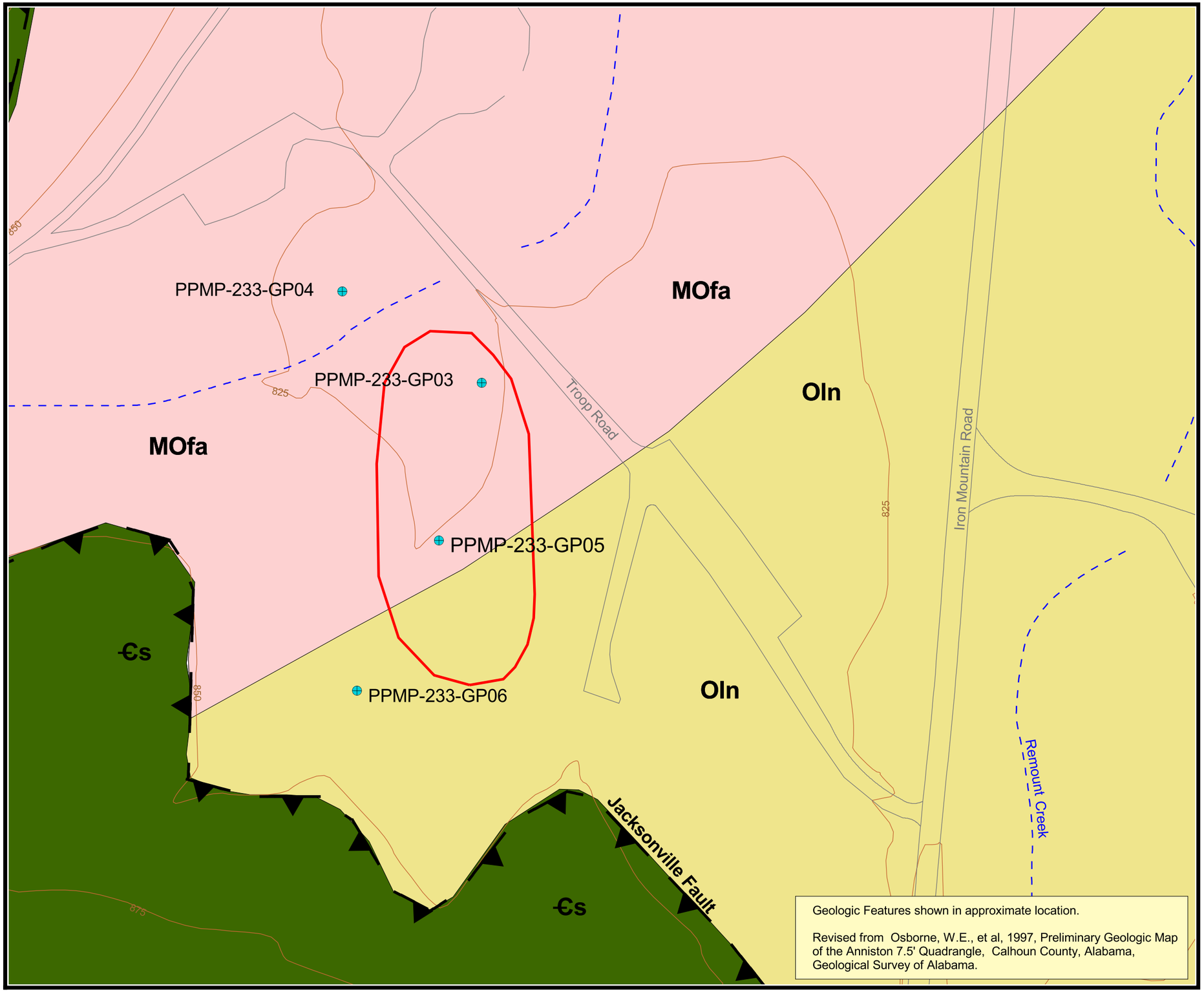
Parcel 233(7) is located approximately 150 feet north of the Jacksonville fault within the southwestern portion of the FTMC geologic window. The site is underlain by the undifferentiated Floyd and Athens Shale and the undifferentiated Little Oak and Newala Limestone (Figure 4-2).

Geologic data collected during hollow-stem auger and air-rotary drilling show alluvial soils underlying Parcel 233(7). These soils range in color from yellowish orange to reddish brown to brown to brownish gray and are comprised of varying combinations of gravel, sand, silt and clay. The gravel found within these soils are generally sub-rounded to angular and are comprised of shale, sandstone, quartzite, and chert.

Figure 4-2

Site Geologic Map

Fill Area West of Range 19
Parcel 233(7)
Fort McClellan, Alabama



Geologic Features shown in approximate location.

Revised from Osborne, W.E., et al, 1997, Preliminary Geologic Map of the Anniston 7.5' Quadrangle, Calhoun County, Alabama, Geological Survey of Alabama.

Legend

- Parcel Boundary
- Roads
- Streams (dashed where intermittent)
- Topographic Contours (Contour Interval - 25 Feet)
- Monitoring Well

Geology

- MOfa — Mississippian/Ordovician - Floyd and Athens Shale, undifferentiated
- Oln — Ordovician - Little Oak and Newala Limestones, undifferentiated
- Cs — Cambrian - Shady Dolomite
- Thrust Fault (dashed where inferred; barbs on upper plate)

100 0 100 Feet

NAD83 State Plane Coordinates

N

Shaw Environmental, Inc.

U.S. Army Corps of Engineers Mobile District

Contract No. DACA21-96-D-0018

X:\ftmc\gisworkarea\jbond\output\geology\parcel233_geology_si.pdf (jremo\gisworkarea\apr\parcel233.apr)

Bedrock was encountered at all four monitoring wells at Parcel 233(7). Weathered brown to black shale consistent with the undifferentiated Floyd and Athens Shale was encountered at monitoring wells PPMP-233-GP03, PPMP-233-GP04, and PPMP-233-GP05. Weathered gray limestone, consistent with the undifferentiated Newala and Little Oak Limestone, was encountered at monitoring well PPMP-233-GP06. Appendix D contains the boring logs and well completion diagrams.

4.5 Site Hydrology

4.5.1 Surface Hydrology

Precipitation in the form of rainfall averages about 53 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The majority of the FTMC Main Post, including Parcel 233(7), is located within the Cane Creek Drainage Basin. Named tributaries to Cane Creek on the Main Post include Cave Creek, Ingram Creek, Remount Creek, and the South Branch of Cane Creek. These waterways flow in a general northwest to westerly direction, emptying into Cane Creek within the confines of the Main Post, with the exception of Cave Creek, which occurs as a separate drainage basin on post. Cave Creek joins Cane Creek approximately 1 mile west of FTMC. Cane Creek then continues in a westerly direction emptying into the Coosa River along the western boundary of Calhoun County.

Parcel 233(7) ranges in elevation from approximately 820 to 835 feet amsl and the ground surface slopes to the north. An intermittent tributary to Remount Creek is located along the northern boundary of the parcel and flows to the northeast. Remount Creek is located approximately 500 feet east of the site and flows to the north. Surface runoff from the site follows the topography to the north, emptying into the tributary to Remount Creek, which joins Remount Creek approximately 1,100 feet northeast of the parcel.

4.5.2 Hydrogeology

Shaw installed four permanent monitoring wells at the Fill Area West of Range 19 in February and March 2000. During well installation activities, groundwater was encountered at between 758 to 777 feet amsl, which was at or just above the soil bedrock contact. During well development in April and May 2000, PPMP-233-GP06 was dry and during sampling in July 2000 only PPMP-233-GP04 produced sufficient water to be sampled.

Static groundwater levels were measured in monitoring wells in the vicinity of Parcel 233(7) as summarized in Table 3-6. Groundwater elevations were calculated by measuring the depth to groundwater relative to the surveyed top-of-casing elevations. A groundwater flow map constructed using the June 2001 data is shown on Figure 4-3. Based on these water level data, groundwater elevations correspond with topography and flow direction across the site is to the northeast towards Remount Creek.

DWG. NO.: ...\796886es.230 | PROJ. NO.: 796886
INITIATOR: B. HEDBERG | PROJ. MGR.: J. YACOUB
DRAFT. CHCK. BY: | ENGR. CHCK. BY: S. MORAN
DATE LAST REV.: | DRAWN BY:
STARTING DATE: 09/16/04 | DRAWN BY: D. BOMAR
9/21/2004 8:20:57 AM
dbomar
c:\cadd\design\796886es.230

E 663,600

N 1,165,300

N 1,164,500

E 664,800

HR-228Q-MW02 (778.53)

HR-232QX-MW14 (804.14)

HR-73Q-MW02 (808.21)

PPMP-233-GP04 (788.15)

HR-232QX-MW15 (751.75)

PPMP-233-GP03

PARCEL 233(7)

PPMP-233-GP05

PPMP-233-GP06

HR-73Q-MW03 (864.06)

G.W. FLOW

TROOP ROAD

IRON MOUNTAIN ROAD

REMOUNT CREEK

LEGEND

- UNIMPROVED ROADS
- PAVED ROADS
- BUILDING
- FORMER BUILDING
- TOPOGRAPHIC CONTOUR (CONTOUR INTERVAL - 25 FOOT)
- GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- (788.15) GROUNDWATER ELEVATION (FT MSL) (JUNE 11, 2001)
- G.W. FLOW GROUNDWATER FLOW DIRECTION
- PARCEL BOUNDARY
- SURFACE DRAINAGE / CREEK W/FLOW DIRECTION
- MANMADE SURFACE DRAINAGE FEATURE W/FLOW DIRECTION
- UTILITY POLE
- MONITORING WELL (DRY) / SURFACE AND SUBSURFACE SOIL LOCATION
- MONITORING WELL /GROUNDWATER, SURFACE AND SUBSURFACE SAMPLE LOCATION

SCALE
0 120 240 FEET

FIGURE 4-3
GROUNDWATER ELEVATION MAP
FILL AREA WEST OF RANGE 19
PARCEL 233(7)

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

Shaw™ Shaw Environmental, Inc.

5.0 Summary of Analytical Results

The results of the chemical analyses of samples collected at the Fill Area West of Range 19, Parcel 233(7), indicate that metals, VOCs, SVOCs, and pesticides were detected in site media. To evaluate whether the detected constituents present an unacceptable risk to human health and the environment, the analytical results were compared to SSSLs and ESVs for FTMC. The SSSLs and ESVs were developed by Shaw for human health and ecological risk evaluations as part of the ongoing SIs being performed under the BRAC Environmental Restoration Program at FTMC.

Metals concentrations exceeding the SSSLs and ESVs were subsequently compared to metals background screening values to determine if the metals concentrations are within natural background concentrations (SAIC, 1998). Site metals data were further evaluated using statistical and geochemical methods to determine if the metals were site related (Appendix J).

The following sections and Tables 5-1 through 5-4 summarize the results of the comparison of detected constituents to the SSSLs, ESVs, and background screening values. Complete analytical results are presented in Appendix H.

5.1 Surface and Depositional Soil Analytical Results

Six surface soil samples and one depositional soil sample were collected for chemical analysis at the Fill Area West of Range 19, Parcel 233(7). Surface and depositional soil samples were collected from the uppermost foot of soil at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs, ESVs, and background screening values, as presented in Table 5-1.

Metals. A total of 19 metals were detected in the surface and depositional soil samples. Six metals (aluminum, arsenic, barium, iron, manganese, and thallium) were detected at concentrations exceeding SSSLs. These metals results, however, were below their respective background concentrations except for the following two metals:

- Barium (1,820 milligrams per kilogram [mg/kg]) exceeded its SSSL (547 mg/kg) and background (124 mg/kg) at sample location PPMP-233-GP06.

- Manganese (2,340 to 9,070 mg/kg) exceeded its SSSL (363 mg/kg) and background (1,579 mg/kg) at sample locations PPMP-233-GP02, PPMP-233-GP03, PPMP-233-GP04, and PPMP-233-GP06.

Table 5-1

Surface and Depositional Soil Analytical Results
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location					PPMP-233-DEP01					PPMP-233-GP01					PPMP-233-GP02				
Sample Number					KZ0015					KZ0001					KZ0005				
Sample Date					2-Jun-00					8-Feb-00					21-Feb-00				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS																			
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	8.29E+03			YES	YES	8.35E+03			YES	YES	1.22E+04	J		YES	YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	9.50E+00			YES		4.30E+00			YES		6.80E+00	J		YES	
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	5.71E+01					7.63E+01					1.44E+02	J	YES		
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	7.70E-01					5.40E-01	J				1.70E+00	J	YES		YES
Calcium	mg/kg	1.72E+03	NA	NA	8.16E+02					2.45E+02	J				2.69E+02	J			
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	1.70E+01				YES	1.10E+01	J			YES	1.14E+01	J			YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	1.09E+01					7.90E+00					3.05E+01	J	YES		YES
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	1.62E+01		YES			6.80E+00	J				1.82E+01	J	YES		
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	3.21E+04			YES	YES	1.31E+04			YES	YES	2.07E+04	J		YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	1.49E+01					1.13E+01					1.83E+01	J			
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	5.25E+02	J				2.44E+02	J				3.59E+02	J			
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	5.59E+02			YES	YES	7.84E+02			YES	YES	3.82E+03	J	YES	YES	YES
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	3.00E-02	J				3.40E-02	J				8.50E-02		YES		
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	1.11E+01		YES			6.80E+00					1.91E+01	J	YES		
Potassium	mg/kg	8.00E+02	NA	NA	7.10E+02					2.51E+02	J				3.96E+02	J			
Silver	mg/kg	3.60E-01	3.91E+01	2.00E+00	ND					ND					ND				
Thallium	mg/kg	3.43E+00	5.08E-01	1.00E+00	9.70E-01	B		YES		6.80E-01	J		YES		ND				
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	3.31E+01				YES	1.70E+01				YES	2.12E+01	J			YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	3.19E+01					1.84E+01					3.97E+01	J			
VOLATILE ORGANIC COMPOUNDS																			
1,1,1-Trichloroethane	mg/kg	NA	1.55E+03	1.00E-01	ND					1.10E-03	J				ND				
Acetone	mg/kg	NA	7.76E+02	2.50E+00	ND					1.10E+00	J				1.30E-02	J			
Cumene	mg/kg	NA	7.77E+02	NA	ND					ND					5.80E-03	J			
Methylene chloride	mg/kg	NA	8.41E+01	2.00E+00	2.20E-03	B				3.10E-03	B				4.50E-03	B			
Naphthalene	mg/kg	3.30E-02	1.55E+02	1.00E-01	ND					ND					ND				
Styrene	mg/kg	NA	1.55E+03	1.00E-01	ND					ND					ND				
Trichlorofluoromethane	mg/kg	NA	2.33E+03	1.00E-01	3.00E-03	J				ND					ND				
p-Cymene	mg/kg	NA	1.55E+03	NA	ND					ND					1.30E-03	J			
SEMIVOLATILE ORGANIC COMPOUNDS																			
Benzo(ghi)perylene	mg/kg	9.55E-01	2.32E+02	1.19E+02	ND					6.50E-02	J				ND				
Bis(2-Ethylhexyl)phthalate	mg/kg	NA	4.52E+01	9.30E-01	ND					4.30E-02	J				6.30E-02	B			
PESTICIDES																			
Endosulfan II	mg/kg	NA	4.66E+01	1.19E-01	ND					ND					ND				

Table 5-1

Surface and Depositional Soil Analytical Results
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location					PPMP-233-GP03					PPMP-233-GP04				
Sample Number					KZ0007					KZ0009				
Sample Date					21-Feb-00					22-Feb-00				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS														
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	1.14E+04	J		YES	YES	1.08E+04	J		YES	YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	8.90E+00	J		YES		6.00E+00	J		YES	
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	1.45E+02	J	YES			1.49E+02	J	YES		
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	1.50E+00	J	YES		YES	1.30E+00	J	YES		YES
Calcium	mg/kg	1.72E+03	NA	NA	1.76E+02	J				4.74E+02	J			
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	1.78E+01	J			YES	2.14E+01	J			YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	2.56E+01	J	YES		YES	1.52E+01	J	YES		
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	1.22E+01	J				1.00E+01	J			
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	2.86E+04	J		YES	YES	2.23E+04	J		YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	1.67E+01	J				1.91E+01	J			
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	3.29E+02	J				4.34E+02	J			
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	3.38E+03	J	YES	YES	YES	2.34E+03	J	YES	YES	YES
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	5.50E-02					6.90E-02				
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	1.93E+01	J	YES			1.20E+01	J	YES		
Potassium	mg/kg	8.00E+02	NA	NA	5.43E+02	J				5.34E+02	J			
Silver	mg/kg	3.60E-01	3.91E+01	2.00E+00	ND					ND				
Thallium	mg/kg	3.43E+00	5.08E-01	1.00E+00	ND					ND				
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	2.62E+01	J			YES	2.03E+01	J			YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	3.46E+01	J				2.55E+01	J			
VOLATILE ORGANIC COMPOUNDS														
1,1,1-Trichloroethane	mg/kg	NA	1.55E+03	1.00E-01	ND					1.10E-03	J			
Acetone	mg/kg	NA	7.76E+02	2.50E+00	4.50E-02	J				4.70E-01	J			
Cumene	mg/kg	NA	7.77E+02	NA	8.40E-04	J				ND				
Methylene chloride	mg/kg	NA	8.41E+01	2.00E+00	5.30E-03	B				5.60E-03	B			
Naphthalene	mg/kg	3.30E-02	1.55E+02	1.00E-01	ND					ND				
Styrene	mg/kg	NA	1.55E+03	1.00E-01	ND					1.10E-03	J			
Trichlorofluoromethane	mg/kg	NA	2.33E+03	1.00E-01	ND					ND				
p-Cymene	mg/kg	NA	1.55E+03	NA	ND					2.20E-03	J			
SEMIVOLATILE ORGANIC COMPOUNDS														
Benzo(ghi)perylene	mg/kg	9.55E-01	2.32E+02	1.19E+02	ND					ND				
Bis(2-Ethylhexyl)phthalate	mg/kg	NA	4.52E+01	9.30E-01	5.30E-02	B				1.10E-01	B			
PESTICIDES														
Endosulfan II	mg/kg	NA	4.66E+01	1.19E-01	ND					ND				

Table 5-1

Surface and Depositional Soil Analytical Results
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location					PPMP-233-GP05					PPMP-233-GP06				
Sample Number					KZ0011					KZ0013				
Sample Date					8-Feb-00					23-Feb-00				
Parameter	Units	BKG[a]	SSSL[b]	ESV[b]	Result	Qual	>BKG	>SSSL	>ESV	Result	Qual	>BKG	>SSSL	>ESV
METALS														
Aluminum	mg/kg	1.63E+04	7.80E+03	5.00E+01	1.23E+04			YES	YES	7.61E+03	J			YES
Arsenic	mg/kg	1.37E+01	4.26E-01	1.00E+01	8.20E+00			YES		8.10E+00	J		YES	
Barium	mg/kg	1.24E+02	5.47E+02	1.65E+02	5.43E+01					1.82E+03	J	YES	YES	YES
Beryllium	mg/kg	8.00E-01	9.60E+00	1.10E+00	9.20E-01		YES			1.60E+00	J	YES		YES
Calcium	mg/kg	1.72E+03	NA	NA	5.69E+01	J				1.61E+02	J			
Chromium	mg/kg	3.70E+01	2.32E+01	4.00E-01	2.15E+01	J			YES	1.61E+01	J			YES
Cobalt	mg/kg	1.52E+01	4.68E+02	2.00E+01	1.91E+01		YES			1.20E+02	J	YES		YES
Copper	mg/kg	1.27E+01	3.13E+02	4.00E+01	1.84E+01	J	YES			2.40E+01	J	YES		
Iron	mg/kg	3.42E+04	2.34E+03	2.00E+02	2.94E+04			YES	YES	2.85E+04	J		YES	YES
Lead	mg/kg	4.01E+01	4.00E+02	5.00E+01	1.40E+01					4.85E+01	J	YES		
Magnesium	mg/kg	1.03E+03	NA	4.40E+05	4.21E+02	J				2.13E+02	J			
Manganese	mg/kg	1.58E+03	3.63E+02	1.00E+02	1.16E+03			YES	YES	9.07E+03	J	YES	YES	YES
Mercury	mg/kg	8.00E-02	2.33E+00	1.00E-01	5.10E-02					4.60E-02				
Nickel	mg/kg	1.03E+01	1.54E+02	3.00E+01	1.47E+01		YES			2.11E+01	J	YES		
Potassium	mg/kg	8.00E+02	NA	NA	5.83E+02	J				2.86E+02	J			
Silver	mg/kg	3.60E-01	3.91E+01	2.00E+00	ND					2.40E-01	J			
Thallium	mg/kg	3.43E+00	5.08E-01	1.00E+00	ND					ND				
Vanadium	mg/kg	5.88E+01	5.31E+01	2.00E+00	3.03E+01				YES	3.57E+01	J			YES
Zinc	mg/kg	4.06E+01	2.34E+03	5.00E+01	4.46E+01		YES			4.28E+01	J	YES		
VOLATILE ORGANIC COMPOUNDS														
1,1,1-Trichloroethane	mg/kg	NA	1.55E+03	1.00E-01	9.50E-04	J				6.90E-04	J			
Acetone	mg/kg	NA	7.76E+02	2.50E+00	2.90E+00	J			YES	4.50E-02	B			
Cumene	mg/kg	NA	7.77E+02	NA	4.80E-03	J				ND				
Methylene chloride	mg/kg	NA	8.41E+01	2.00E+00	3.00E-03	B				4.90E-03	B			
Naphthalene	mg/kg	3.30E-02	1.55E+02	1.00E-01	ND					8.80E-04	J			
Styrene	mg/kg	NA	1.55E+03	1.00E-01	ND					ND				
Trichlorofluoromethane	mg/kg	NA	2.33E+03	1.00E-01	ND					ND				
p-Cymene	mg/kg	NA	1.55E+03	NA	5.20E-03	J				ND				
SEMIVOLATILE ORGANIC COMPOUNDS														
Benzo(ghi)perylene	mg/kg	9.55E-01	2.32E+02	1.19E+02	ND					ND				
Bis(2-Ethylhexyl)phthalate	mg/kg	NA	4.52E+01	9.30E-01	ND					8.90E-02	B			
PESTICIDES														
Endosulfan II	mg/kg	NA	4.66E+01	1.19E-01	6.70E-04	J				ND				

Table 5-1

Surface and Depositional Soil Analytical Results
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] Bkg - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC (1998), *Final Background Metals Survey Report, Fort McClellan, Calhoun County, Alabama*, July.
For SVOCs, value listed is the background screening criterion for soils adjacent to asphalt as given in IT (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama,* July.
[b] Residential human health site-specific screening level (SSSL) and ecological screening value (ESV) as given in IT (2000).
B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit.
J - Compound was positively identified; reported value is an estimated concentration.
mg/kg - Milligrams per kilogram.
NA - Not available.
ND - Not detected.
Qual - Data validation qualifier.

Table 5-2

Subsurface Soil Analytical Results
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location				PPMP-233-GP01				PPMP-233-GP02				PPMP-233-GP03			
Sample Number				KZ0004				KZ0006				KZ0008			
Sample Date				8-Feb-00				21-Feb-00				21-Feb-00			
Sample Depth (Feet)				10 - 12				10 - 12				10 - 12			
Parameter	Units	BKG[a]	SSSL[b]	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL
METALS															
Aluminum	mg/kg	1.36E+04	7.80E+03	6.04E+03				4.03E+03	J			4.34E+03	J		
Arsenic	mg/kg	1.83E+01	4.26E-01	1.34E+01			YES	1.01E+01	J		YES	7.90E+00	J		YES
Barium	mg/kg	2.34E+02	5.47E+02	2.07E+01	J			5.33E+01	J			1.06E+03	J	YES	YES
Beryllium	mg/kg	8.60E-01	9.60E+00	1.10E+00		YES		1.80E+00	J	YES		4.60E+00	J	YES	
Cadmium	mg/kg	2.20E-01	6.25E+00	ND				ND				1.20E+00	J	YES	
Calcium	mg/kg	6.37E+02	NA	3.43E+01	B			2.65E+01	B			4.11E+01	B		
Chromium	mg/kg	3.83E+01	2.32E+01	1.70E+01	J			7.10E+00	J			9.10E+00	J		
Cobalt	mg/kg	1.75E+01	4.68E+02	5.50E+00	J			4.22E+01	J	YES		1.13E+02	J	YES	
Copper	mg/kg	1.94E+01	3.13E+02	1.96E+01	J	YES		2.41E+01	J	YES		2.09E+01	J	YES	
Iron	mg/kg	4.48E+04	2.34E+03	2.79E+04			YES	3.02E+04	J		YES	7.98E+04	J	YES	YES
Lead	mg/kg	3.85E+01	4.00E+02	1.68E+01				2.47E+01	J			1.11E+01	J		
Magnesium	mg/kg	7.66E+02	NA	2.10E+02	J			1.28E+02	J			1.04E+02	J		
Manganese	mg/kg	1.36E+03	3.63E+02	2.65E+02				1.24E+03	J		YES	2.02E+04	J	YES	YES
Mercury	mg/kg	7.00E-02	2.33E+00	2.40E-02	J			4.80E-02				8.80E-02		YES	
Nickel	mg/kg	1.29E+01	1.54E+02	1.86E+01		YES		3.00E+01	J	YES		8.35E+01	J	YES	
Potassium	mg/kg	7.11E+02	NA	4.08E+02	J			6.07E+02	J			1.76E+03	J	YES	
Selenium	mg/kg	4.70E-01	3.91E+01	ND				ND				5.00E-01	J	YES	
Silver	mg/kg	2.40E-01	3.91E+01	ND				ND				3.90E-01	J	YES	
Thallium	mg/kg	1.40E+00	5.08E-01	7.70E-01	J		YES	8.40E-01	B		YES	ND			
Vanadium	mg/kg	6.49E+01	5.31E+01	2.76E+01				1.67E+01	J			1.37E+01	J		
Zinc	mg/kg	3.49E+01	2.34E+03	1.37E+02		YES		9.66E+01	J	YES		1.48E+02	J	YES	
SEMIVOLATILE ORGANIC COMPOUNDS															
Bis(2-Ethylhexyl)phthalate	mg/kg	NA	4.52E+01	ND				6.00E-02	B			5.00E-02	B		
Di-n-octyl phthalate	mg/kg	NA	1.56E+02	ND				ND				ND			
VOLATILE ORGANIC COMPOUNDS															
1,1,1-Trichloroethane	mg/kg	NA	1.55E+03	1.10E-03	J			8.80E-04	J			ND			
Acetone	mg/kg	NA	7.76E+02	ND				1.50E-02	J			ND			
Methylene chloride	mg/kg	NA	8.41E+01	3.00E-03	B			5.80E-03	B			5.40E-03	B		
Trichlorofluoromethane	mg/kg	NA	2.33E+03	3.00E-03	J			ND				ND			

Table 5-2

Subsurface Soil Analytical Results
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location				PPMP-233-GP04				PPMP-233-GP05				PPMP-233-GP06			
Sample Number				KZ0010				KZ0012				KZ0014			
Sample Date				22-Feb-00				8-Feb-00				24-Feb-00			
Sample Depth (Feet)				10 - 12				10 - 12				8 - 10			
Parameter	Units	BKG[a]	SSSL[b]	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL	Result	Qual	>BKG	>SSSL
METALS															
Aluminum	mg/kg	1.36E+04	7.80E+03	1.22E+04	J		YES	3.33E+03				8.10E+03	J		YES
Arsenic	mg/kg	1.83E+01	4.26E-01	5.80E+00	J		YES	7.40E+00			YES	1.04E+01	J		YES
Barium	mg/kg	2.34E+02	5.47E+02	3.55E+01	J			2.08E+01	J			5.58E+01	J		
Beryllium	mg/kg	8.60E-01	9.60E+00	6.60E-01	B			3.20E+00		YES		8.20E-01	J		
Cadmium	mg/kg	2.20E-01	6.25E+00	ND				ND				ND			
Calcium	mg/kg	6.37E+02	NA	2.68E+01	B			1.45E+01	B			6.97E+01	J		
Chromium	mg/kg	3.83E+01	2.32E+01	2.50E+01	J		YES	9.70E+00	J			2.32E+01	J		YES
Cobalt	mg/kg	1.75E+01	4.68E+02	2.06E+01	J	YES		1.09E+01				1.53E+01	J		
Copper	mg/kg	1.94E+01	3.13E+02	3.22E+01	J	YES		2.99E+01	J	YES		2.99E+01	J	YES	
Iron	mg/kg	4.48E+04	2.34E+03	4.56E+04	J	YES	YES	3.76E+04			YES	3.63E+04	J		YES
Lead	mg/kg	3.85E+01	4.00E+02	1.80E+01	J			1.15E+01				1.45E+01	J		
Magnesium	mg/kg	7.66E+02	NA	1.97E+02	J			2.22E+02	J			3.12E+02	J		
Manganese	mg/kg	1.36E+03	3.63E+02	3.34E+02	J			3.65E+02			YES	6.94E+02	J		YES
Mercury	mg/kg	7.00E-02	2.33E+00	5.10E-02				4.30E-02				4.20E-02			
Nickel	mg/kg	1.29E+01	1.54E+02	9.50E+00	J			3.91E+01		YES		1.66E+01	J	YES	
Potassium	mg/kg	7.11E+02	NA	6.02E+02	J			9.87E+02		YES		1.33E+03	J	YES	
Selenium	mg/kg	4.70E-01	3.91E+01	ND				ND				ND			
Silver	mg/kg	2.40E-01	3.91E+01	ND				ND				ND			
Thallium	mg/kg	1.40E+00	5.08E-01	9.60E-01	B		YES	8.30E-01	J		YES	8.50E-01	B		YES
Vanadium	mg/kg	6.49E+01	5.31E+01	4.40E+01	J			1.58E+01				3.27E+01	J		
Zinc	mg/kg	3.49E+01	2.34E+03	2.59E+01	J			1.27E+02		YES		3.62E+01	J	YES	
SEMIVOLATILE ORGANIC COMPOUNDS															
Bis(2-Ethylhexyl)phthalate	mg/kg	NA	4.52E+01	1.20E-01	B			ND				5.80E-01	B		
Di-n-octyl phthalate	mg/kg	NA	1.56E+02	ND				ND				1.90E-01	J		
VOLATILE ORGANIC COMPOUNDS															
1,1,1-Trichloroethane	mg/kg	NA	1.55E+03	ND				1.40E-03	J			8.40E-04	J		
Acetone	mg/kg	NA	7.76E+02	ND				ND				7.80E-03	B		
Methylene chloride	mg/kg	NA	8.41E+01	4.00E-03	B			3.90E-03	B			5.60E-03	B		
Trichlorofluoromethane	mg/kg	NA	2.33E+03	ND				ND				ND			

Table 5-2

Subsurface Soil Analytical Results
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] Bkg - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in SAIC (1998), *Final Background Metals Survey Report, Fort McClellan, Calhoun County, Alabama*, July.
[b] Residential human health site-specific screening level (SSSL) as given in IT (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama*, July.
B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).
J - Compound was positively identified; reported value is an estimated concentration.
mg/kg - Milligrams per kilogram.
NA - Not available.
ND - Not detected.
Qual - Data validation qualifier.

Table 5-3

Groundwater Analytical Results
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Sample Location				PPMP-233-GP04			
Sample Number				KZ3004			
Sample Date				14-Jul-00			
Parameter	Units	BKG[a]	SSSL[b]	Result	Qual	>BKG	>SSSL
METALS							
Aluminum	mg/L	2.34E+00	1.56E+00	4.46E-01	B		
Barium	mg/L	1.27E-01	1.10E-01	1.30E-02	J		
Calcium	mg/L	5.65E+01	NA	7.16E-01	J		
Chromium	mg/L	NA	4.69E-03	1.30E-01	J		YES
Cobalt	mg/L	2.34E-02	9.39E-02	1.07E-02	J		
Iron	mg/L	7.04E+00	4.69E-01	2.09E+00	J		YES
Magnesium	mg/L	2.13E+01	NA	2.74E-01	B		
Manganese	mg/L	5.81E-01	7.35E-02	1.91E-01			YES
Mercury	mg/L	NA	4.69E-04	9.90E-05	B		
Nickel	mg/L	NA	3.13E-02	7.04E-02	J		YES
Potassium	mg/L	7.20E+00	NA	1.22E+00	J		
Sodium	mg/L	1.48E+01	NA	1.75E+00	J		
Zinc	mg/L	2.20E-01	4.69E-01	1.52E-02	J		
PESTICIDES							
4,4'-DDD	mg/L	NA	1.83E-04	7.40E-05	J		
Aldrin	mg/L	NA	3.90E-06	3.40E-05	J		YES
Endosulfan II	mg/L	NA	9.35E-03	1.60E-05	J		
delta-BHC	mg/L	NA	4.49E-04	3.30E-05	J		

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] Bkg - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in Science Applications International Corporation (1998), *Final Background Metals Survey Report, Fort McClellan, Alabama,* July.

[b] Residential human health site-specific screening level (SSSL) as given in IT (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama, July.*

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit.

J - Compound was positively identified; reported value is an estimated concentration.

mg/L - Milligrams per liter.

NA - Not available.

Qual - Data validation qualifier.

Table 5-4

Chromium and Nickel Groundwater Analytical Results in Nearby Wells
Fill Area West of Range 19, Parcel 233(7)
Fort McClellan, Calhoun County, Alabama

Well Designation Sample Number Sample Date Location Relative to Parcel 233(7)				HR-73Q-MW02 JF3002 10-May-01 400' upgradient			HR-73Q-MW03 JF3005 18-Apr-01 800' upgradient			HR-228Q-MW02 JS3002 14-May-01 400' sidegradient			HR-232QX-MW15 ECC3015 6-Jun-01 200' downgradient		
Parameter	**Units**	**BKG[a]**	**SSSL[b]**	**Result**	**Qual**	**>SSSL**	**Result**	**Qual**	**>SSSL**	**Result**	**Qual**	**>SSSL**	**Result**	**Qual**	**>SSSL**
METALS															
Chromium	mg/L	NA	4.69E-03	ND			ND			ND			ND		
Nickel	mg/L	NA	3.13E-02	ND			1.58E-02	B		ND			ND		

Analyses performed using U.S. Environmental Protection Agency (EPA) SW-846 analytical methods.

[a] Bkg - Background. Concentration listed is two times (2x) the arithmetic mean of background metals concentration given in Science Applications International Corporation (1998), *Final Background Metals Survey Report, Fort McClellan, Alabama,* July.

[b] Residential human health site-specific screening level (SSSL) as given in IT (2000), *Final Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama,* July.

B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit.
mg/L - Milligrams per liter.
NA - Not available.
ND - Not detected.
Qual - Data validation qualifier.

The concentrations of eight metals exceeded ESVs: aluminum, barium, beryllium, chromium, cobalt, iron, manganese, and vanadium. Of these, the following metals also exceeded their respective background concentrations in one or more samples:

- Barium (1,820 mg/kg) exceeded its ESV (165 mg/kg) and background (124 mg/kg) at one sample location (PPMP-233-GP06).

- Beryllium (1.3 to 1.7 mg/kg) exceeded its ESV (1.1 mg/kg) and background (0.8 mg/kg) at four sample locations (PPMP-233-GP02, PPMP-233-GP03, PPMP-233-GP04, and PPMP-233-GP06).

- Cobalt (25.6 to 120 mg/kg) exceeded its ESV (20 mg/kg) and background (15.2 mg/kg) at three sample locations (PPMP-233-GP02, PPMP-233-GP03, and PPMP-233-GP06).

- Manganese (2,340 to 9,070 mg/kg) exceeded its ESV (100 mg/kg) and background (1,579 mg/kg) at four locations (PPMP-233-GP02, PPMP-233-GP03, PPMP-233-GP04, and PPMP-233-GP06).

Volatile Organic Compounds. A total of eight VOCs were detected in the surface and depositional soil samples: 1,1,1-trichloroethane, acetone, cumene, methylene chloride, naphthalene, p-cymene, styrene, and trichlorofluoromethane. The methylene chloride results and one acetone result were flagged with a "B" data qualifier, indicating that these compounds were also detected in an associated laboratory or field blank sample. The remaining VOC results were flagged with a "J" data qualifier, indicating that the concentrations were estimated. VOC concentrations in surface and depositional soils ranged from 0.00069 to 2.9 mg/kg.

The VOC concentrations were below SSSLs and ESVs except for one acetone result (2.9 mg/kg), which minimally exceeded its ESV (2.5 mg/kg) at sample location PPMP-233-GP05.

Semivolatile Organic Compounds. Two SVOCs were detected in the surface and depositional soil samples: the PAH compound benzo(ghi)perylene and bis(2-ethylhexyl)phthalate. Four of the five bis(2-ethylhexyl)phthalate results were flagged with a "B" data qualifier, indicating that this compound was also detected in an associated laboratory or field blank sample. The remaining bis(2-ethylhexyl)phthalate result and the single benzo(ghi)perylene result were flagged with a "J" data qualifier, indicating that the concentrations were estimated. SVOC concentrations in surface and depositional soils ranged from 0.043 to 0.11 mg/kg and all results were below SSSLs and ESVs.

Pesticides. One pesticide, endosulfan II, was detected in surface soil sample location PPMP-233-GP05. This result was flagged with a "J" data qualifier, indicating that the concentration was estimated. The endosulfan II result (0.00067 mg/kg) was well below its SSSL (46.6 mg/kg) and ESV (0.119 mg/kg).

Herbicides. Herbicides were not detected in the surface and depositional soil samples.

Polychlorinated Biphenyls. PCBs were not detected in the surface and depositional soil samples.

5.2 Subsurface Soil Analytical Results

Six subsurface soil samples were collected for chemical analysis at the Fill Area West of Range 19, Parcel 233(7). Subsurface soil samples were collected at depths greater than 1 foot bgs at the locations shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background concentrations as presented in Table 5-2.

Metals. A total of 21 metals were detected in the subsurface soil samples. The concentrations of seven metals (aluminum, arsenic, barium, chromium, iron, manganese, and thallium) exceeded SSSLs. Of these, three metals also exceeded their respective background values in one or two samples as follows:

- Barium (1,060 mg/kg) exceeded its SSSL (547 mg/kg) and background (234 mg/kg) at sample location PPMP-233-GP03.
- Iron (45,600 and 78,900 mg/kg) exceeded its SSSL (2,345 mg/kg) and background (44,817 mg/kg) at two sample locations (PPMP-233-GP03 and PPMP-233-GP04).
- Manganese (20,200 mg/kg) exceeded its SSSL (363 mg/kg) and background (1,355 mg/kg) at sample location PPMP-233-GP03.

Volatile Organic Compounds. A total of four VOCs were detected in the subsurface soil samples: 1,1,1-trichloroethane, acetone, methylene chloride, and trichlorofluoromethane. All the VOC results were flagged with either a "B" data qualifier, indicating that these compounds were also detected in an associated laboratory or field blank sample, or a "J" data qualifier, indicating that the concentrations were estimated. VOC concentrations in subsurface soils ranged from 0.00084 to 0.1 mg/kg and all results were below SSSLs.

Semivolatile Organic Compounds. Two SVOCs (bis[2-ethylhexyl]phthalate and di-n-octyl phthalate) were detected in the subsurface soil samples. The bis(2-ethylhexyl)phthalate results were "B" flagged, indicating that the compound was also detected in an associated laboratory or field blank sample. The single di-n-octyl phthalate result was flagged with a "J" data qualifier, indicating that the concentration was estimated. All the SVOC results were below SSSLs.

Pesticides. Pesticides were not detected in the subsurface soil samples.

Herbicides. Herbicides were not detected in the subsurface soil samples.

Polychlorinated Biphenyls. PCBs were not detected in the subsurface soil samples.

Explosives. One subsurface soil sample (location PPMP-233-GP05) was analyzed for explosives. Explosives were not detected in the sample.

5.3 Groundwater Analytical Results

One groundwater sample was collected at the Fill Area West of Range 19, Parcel 233(7), at the location shown on Figure 3-1. Analytical results were compared to residential human health SSSLs and metals background concentrations as presented in Table 5-3.

Metals. Thirteen metals were detected in the groundwater sample. The aluminum, magnesium, and mercury results were flagged with a "B" data qualifier, indicating that these metals were also detected in an associated laboratory or field blank sample. All of the other metals results except manganese were "J" flagged, indicating that the concentrations were estimated. The concentrations of four metals (chromium, iron, manganese, and nickel) exceeded SSSLs. The iron and manganese results were below their respective background concentrations. Background values for chromium and nickel were not available.

Volatile Organic Compounds. VOCs were not detected in the groundwater sample.

Semivolatile Organic Compounds. SVOCs were not detected in the groundwater sample.

Pesticides. Four pesticides were detected in the groundwater sample: 4,4-dichlorodiphenyldichloroethane (DDD), aldrin, endosulfan II, and delta-hexachlorocyclohexane (BHC). All of the pesticide results were "J" flagged, indicating that the concentrations were estimated. The pesticide concentrations in the sample ranged from

0.000016 to 0.000074 mg/L and were below their respective SSSLs, except for aldrin. The aldrin result (0.000034 mg/L) exceeded its SSSL (0.0000039 mg/L).

Herbicides. Herbicides were not detected in the groundwater sample.

Polychlorinated Biphenyls. PCBs were not detected in the groundwater sample.

5.4 Statistical and Geochemical Evaluation of Site Metals Data

Site metals data were further evaluated using statistical and geochemical methods to determine if the metals are site related (Appendix J). This multi-tiered approach is described in the technical memorandum "Selecting Site-Related Chemicals for Human Health and Ecological Risk Assessments for FTMC: Revision 2" (Shaw, 2003b). The statistical and geochemical evaluation determined that the metals detected in site media are present at naturally occurring levels, with the exception of chromium and nickel in the groundwater sample. The chromium and nickel results were judged to be anomalously high relative to the reference elements and may be indicative of contamination.

5.5 Additional Chromium and Nickel Groundwater Data Evaluation

To further address chromium and nickel in groundwater, groundwater data were evaluated from four additional wells that closely surround the site (as shown on Figure 3-1). Two of these wells (HR-73Q-MW02 and HR-73Q-MW03) are located upgradient approximately 400 and 800 feet of the site, respectively. One well (HR-232QX-MW15) is located downgradient at a distance of approximately 200 feet and one well (HR-228Q-MW02) is located sidegradient at a distance of approximately 400 feet.

The data from the surrounding wells indicate that chromium was not detected in any of the wells (Table 5-4). Although nickel was detected in one upgradient well (HR-73Q-MW03), the result was "B" flagged, indicating the presence of laboratory artifacts. This result was below the SSSL.

It is also worth noting that the field duplicate sample collected at PPMP-233-GP04 (data shown in Appendix H) contained considerably lower concentrations of both chromium and nickel. The estimated nickel concentration in the duplicate sample (0.0152 mg/L) was below its SSSL (0.031 mg/L) and was approximately five times lower than the concentration in the regular field sample (0.0704 mg/L). The estimated chromium concentration in the duplicate sample (0.0217 mg/L) exceeded the SSSL (0.0047 mg/L) but was approximately six times lower than the concentration in the field sample (0.13 mg/L).

6.0 Summary, Conclusions, and Recommendations

Shaw completed an SI at the Fill Area West of Range 19, Parcel 233(7), at FTMC in Calhoun County, Alabama. The SI was conducted to determine whether chemical constituents are present at the site as a result of mission-related Army activities. SI field activities consisted of the collection and analysis of six surface soil samples, one depositional soil sample, six subsurface soil samples, and one groundwater sample. In addition, four monitoring wells were installed to facilitate sample collection and to provide site-specific geological and hydrogeological characterization information. However, only one well produced sufficient groundwater for sampling during the investigation. Additional SI activities included a geophysical survey and exploratory trenching as well as a wetlands study.

The geophysical survey identified one area of anomalously high conductivity. However, exploratory trenching performed within the area did not indicate the presence of fill material. Additionally, the wetlands study concluded that wetlands are not present on or within 200 feet of Parcel 233(7).

Chemical analysis of samples collected at the site indicates that metals, VOCs, SVOCs, and pesticides were detected in site media. To evaluate whether the detected constituents pose an unacceptable risk to human health or the environment, the analytical results were compared to human health SSSLs, ESVs, and background screening values for FTMC. Additionally, site metals data were evaluated using statistical and geochemical methods to determine if the metals detected in site media were naturally occurring.

Three metals in soil (barium, iron, and manganese) and two metals in groundwater (chromium and nickel) were detected at concentrations exceeding SSSLs and background (where available) and, thus, were selected as COPCs. The statistical and geochemical evaluations determined that these metals were naturally occurring, except for chromium and nickel in groundwater. To address the presence of chromium and nickel in groundwater, groundwater data were evaluated from four additional wells that surround the site. The data from the surrounding wells indicated that chromium was not detected in any of the wells and nickel was detected in only one upgradient well (800 feet away) at a level below the SSSL. Therefore, the chromium and nickel detected in groundwater at Parcel 233(7) appear to be isolated occurrences, and are not believed to pose an unacceptable threat to human health. The pesticide aldrin was also identified as a COPC in groundwater because it was detected at an estimated concentration exceeding its SSSL.

An SRA was completed as part of the EE/CA for Parcel 233(7). The SRA concluded that aldrin in groundwater was not a human health concern because the calculated risk was within acceptable limits (IT, 2002b).

Four metals (barium, beryllium, cobalt, and manganese) were detected in surface soil at concentrations exceeding ESVs and background and, thus, were selected as constituents of potential ecological concern (COPEC). However, the statistical and geochemical evaluation determined that these metals were all naturally occurring. The VOC acetone was also identified as a COPEC in surface soil because it was detected at an estimated concentration minimally exceeding its ESV in one sample. Based on the relatively small amount by which the acetone result exceeded the ESV, coupled with the destruction of much of the terrestrial habitat through construction of the Eastern Bypass Highway, it is concluded that acetone does not pose an unacceptable threat to ecological receptors at this site. This conclusion is consistent with the findings of the SLERA completed as part of the EE/CA (IT, 2002b).

Based on the results of the SI, including confirmation that fill material is not present, potential historical activities at the Fill Area West of Range 19, Parcel 233(7), have not adversely impacted the environment. The metals and chemical compounds detected in site media do not pose an unacceptable risk to human health and the environment. Therefore, Shaw recommends "No Further Action" and unrestricted land reuse with regard to CERCLA-related hazardous substances at the Fill Area West of Range 19, Parcel 233(7).

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ATTACHMENT 1

LIST OF ABBREVIATIONS AND ACRONYMS

List of Abbreviations and Acronyms

2-ADNT	2-amino-4,6-dinitrotoluene
4-ADNT	4-amino-2,6-dinitrotoluene
2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4,5-TP	2,4,5-trichlorophenoxypropionic acid
3D	3D International Environmental Group
AB	ambient blank
AbB3	Anniston gravelly clay loam, 2 to 6 percent slopes, severely eroded
AbC3	Anniston gravelly clay loam, 6 to 10 percent slopes, severely eroded
AbD3	Anniston and Allen gravelly clay loams, 10 to 15 percent slopes, eroded
ABLM	adult blood lead model
Abs	skin absorption
ABS	dermal absorption factor
AC	hydrogen cyanide
ACAD	AutoCadd
AcB2	Anniston and Allen gravelly loams, 2 to 6 percent slopes, eroded
AcC2	Anniston and Allen gravelly loams, 6 to 10 percent slopes, eroded
AcD2	Anniston and Allen gravelly loams, 10 to 15 percent slopes, eroded
AcE2	Anniston and Allen gravelly loams, 15 to 25 percent slopes, eroded
ACGIH	American Conference of Governmental Industrial Hygienists
AdE	Anniston and Allen stony loam, 10 to 25 percent slope
ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
AEC	U.S. Army Environmental Center
AEDA	ammunition, explosives, and other dangerous articles
AEL	airborne exposure limit
AET	adverse effect threshold
AF	soil-to-skin adherence factor
AHA	ammunition holding area
AL	Alabama
ALARNG	Alabama Army National Guard
ALAD	δ-aminolevulinic acid dehydratase
ALDOT	Alabama Department of Transportation
amb.	amber
amsl	above mean sea level
ANAD	Anniston Army Depot
AOC	area of concern
AP	armor piercing
APEC	areas of potential ecological concern
APT	armor-piercing tracer
AR	analysis request
ARAR	applicable or relevant and appropriate requirement
AREE	area requiring environmental evaluation
AS/SVE	air sparging/soil vapor extraction
ASP	Ammunition Supply Point
ASR	Archives Search Report
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
AT	averaging time
atm-m^3/mol	atmospheres per cubic meter per mole
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all-terrain vehicle
AUF	area use factor
AWARE	Associated Water and Air Resources Engineers, Inc.
AWQC	ambient water quality criteria
AWWSB	Anniston Water Works and Sewer Board
'B'	Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero)
BAF	bioaccumulation factor
BBGR	Baby Bains Gap Road
BCF	blank correction factor; bioconcentration factor
BCT	BRAC Cleanup Team
BERA	baseline ecological risk assessment
BEHP	bis(2-ethylhexyl)phthalate
BFB	bromofluorobenzene
BFE	base flood elevation
BG	Bacillus globigii
BGR	Bains Gap Road
bgs	below ground surface
BHC	hexachlorocyclohexane
BHHRA	baseline human health risk assessment
BIRTC	Branch Immaterial Replacement Training Center
bkg	background
bls	below land surface
BOD	biological oxygen demand
Bp	soil-to-plant biotransfer factors
BRAC	Base Realignment and Closure
Braun	Braun Intertec Corporation
BSAF	biota-to-sediment accumulation factors
BSC	background screening criterion
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethyl benzene, and xylenes
BTOC	below top of casing
BTV	background threshold value
BW	biological warfare; body weight
BZ	breathing zone; 3-quinuclidinyl benzilate
C	ceiling limit value
Ca	carcinogen
$CaCO_3$	calcium carbonate
CAA	Clean Air Act
CAB	chemical warfare agent breakdown products
CACM	Chemical Agent Contaminated Media
CAMU	corrective action management unit
CBR	chemical, biological, and radiological
CCAL	continuing calibration
CCB	continuing calibration blank
CCV	continuing calibration verification
CD	compact disc
CDTF	Chemical Defense Training Facility
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CESAS	Corps of Engineers South Atlantic Savannah
CF	conversion factor
CFC	chlorofluorocarbon
CFDP	Center for Domestic Preparedness
CFR	Code of Federal Regulations
CG	phosgene (carbonyl chloride)
CGI	combustible gas indicator
ch	inorganic clays of high plasticity
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
CIH	Certified Industrial Hygienist
CK	cyanogen chloride
cl	inorganic clays of low to medium plasticity
Cl	chlorinated
CLP	Contract Laboratory Program
cm	centimeter
CN	chloroacetophenone
CNB	chloroacetophenone, benzene, and carbon tetrachloride
CNS	chloroacetophenone, chloropicrin, and chloroform
CO	carbon monoxide
CO_2	carbon dioxide
Co-60	cobalt-60
CoA	Code of Alabama
COC	chain of custody; chemical of concern
COE	Corps of Engineers
Con	skin or eye contact
COPC	chemical of potential concern
COPEC	constituent of potential ecological concern
CPOM	coarse particulate organic matter
CPSS	chemicals present in site samples
CQCSM	Contract Quality Control System Manager
CRDL	contract-required detection limit
CRL	certified reporting limit
CRQL	contract-required quantitation limit
CRZ	contamination reduction zone
Cs-137	cesium-137
CS	ortho-chlorobenzylidene-malononitrile
CSEM	conceptual site exposure model
CSM	conceptual site model
CT	central tendency
ctr.	container
CWA	chemical warfare agent; Clean Water Act
CWM	chemical warfare material; clear, wide mouth

CX	dichloroformoxime
'D'	duplicate; dilution
D&I	detection and identification
DAAMS	depot area agent monitoring station
DAF	dilution-attenuation factor
DANC	decontamination agent, non-corrosive
ºC	degrees Celsius
ºF	degrees Fahrenheit
DCA	dichloroethane
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEH	Directorate of Engineering and Housing
DEHP	di(2-ethylhexyl)phthalate
DEP	depositional soil
DFTPP	decafluorotriphenylphosphine
DI	deionized
DID	data item description
DIMP	di-isopropylmethylphosphonate
DM	dry matter; adamsite
DMBA	dimethylbenz(a)anthracene
DMMP	dimethylmethylphosphonate
DNAPL	dense nonaqueous-phase liquid
DNT	dinitrotoluene
DO	dissolved oxygen
DOD	U.S. Department of Defense
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
DP	direct-push
DPDO	Defense Property Disposal Office
DPT	direct-push technology
DQO	data quality objective
DRMO	Defense Reutilization and Marketing Office
DRO	diesel range organics
DS	deep (subsurface) soil
DS2	Decontamination Solution Number 2
DSERTS	Defense Site Environmental Restoration Tracking System
DWEL	drinking water equivalent level
E&E	Ecology and Environment, Inc.
EB	equipment blank
EBS	environmental baseline survey
EC_{20}	effects concentration for 20 percent of a test population
EC_{50}	effects concentration for 50 percent of a test population
ECBC	Edgewood Chemical Biological Center
ED	exposure duration
EDD	electronic data deliverable
EF	exposure frequency
EDQL	ecological data quality level
EE/CA	engineering evaluation and cost analysis
Eh	oxidation-reduction potential
Elev.	elevation
EM	electromagnetic
EMI	Environmental Management Inc.
EM31	Geonics Limited EM31 Terrain Conductivity Meter
EM61	Geonics Limited EM61 High-Resolution Metal Detector
EOD	explosive ordnance disposal
EODT	explosive ordnance disposal team
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EPIC	Environmental Photographic Interpretation Center
EPRI	Electrical Power Research Institute
EPT	Ephemeroptera, Plecoptera, Trichoptera
ER	equipment rinsate
ERA	ecological risk assessment
ER-L	effects range-low
ER-M	effects range-medium
ESE	Environmental Science and Engineering, Inc.
ESL	ecological screening level
ESMP	Endangered Species Management Plan
ESN	Environmental Services Network, Inc.
ESV	ecological screening value
ET	exposure time
EU	exposure unit
Exp.	Explosives
EXTOXNET	Extension Toxicology Network
E-W	east to west
EZ	exclusion zone
FAR	Federal Acquisition Regulations
FB	field blank
FBI	Family Biotic Index
FD	field duplicate
FDC	Former Decontamination Complex
FDA	U.S. Food and Drug Administration
Fe^{+3}	ferric iron
Fe^{+2}	ferrous iron
FedEx	Federal Express, Inc.
FEMA	Federal Emergency Management Agency
FFCA	Federal Facilities Compliance Act
FFE	field flame expedient
FFS	focused feasibility study
FI	fraction of exposure
Fil	filtered
Flt	filtered
FMDC	Fort McClellan Development Commission
FML	flexible membrane liner
f_{oc}	fraction organic carbon
FOMRA	Former Ordnance Motor Repair Area
FOST	Finding of Suitability to Transfer
Foster Wheeler	Foster Wheeler Environmental Corporation
FR	Federal Register
Frtn	fraction
FS	field split; feasibility study
FSP	field sampling plan
ft	feet
ft/day	feet per day
ft/ft	feet per foot
ft/yr	feet per year
FTA	Fire Training Area
FTMC	Fort McClellan
FTRRA	FTMC Reuse & Redevelopment Authority
g	gram
g/m^3	gram per cubic meter
G-856	Geometrics, Inc. G-856 magnetometer
G-858G	Geometrics, Inc. G-858G magnetic gradiometer
GAF	gastrointestinal absorption factor
gal	gallon
gal/min	gallons per minute
GB	sarin (isopropyl methylphosphonofluoridate)
gc	clay gravels; gravel-sand-clay mixtures
GC	gas chromatograph
GCL	geosynthetic clay liner
GC/MS	gas chromatograph/mass spectrometer
GCR	geosynthetic clay liner
GFAA	graphite furnace atomic absorption
GIS	Geographic Information System
gm	silty gravels; gravel-sand-silt mixtures
gp	poorly graded gravels; gravel-sand mixtures
gpm	gallons per minute
GPR	ground-penetrating radar
GPS	global positioning system
GRA	general response action
GS	ground scar
GSA	General Services Administration; Geologic Survey of Alabama
GSBP	Ground Scar Boiler Plant
GSSI	Geophysical Survey Systems, Inc.
GST	ground stain
GW	groundwater
gw	well-graded gravels; gravel-sand mixtures
H&S	health and safety
HA	hand auger
HC	mixture of hexachloroethane, aluminum powder, and zinc oxide (smoke producer)
HCl	hydrochloric acid
HD	distilled mustard (bis-[dichloroethyl]sulfide)

HDPE	high-density polyethylene
HE	high explosive
HEAST	Health Effects Assessment Summary Tables
Herb.	herbicides
HHRA	human health risk assessment
HI	hazard index
H_2O_2	hydrogen peroxide
HPLC	high-performance liquid chromatography
HNO_3	nitric acid
HQ	hazard quotient
HQ_{screen}	screening-level hazard quotient
hr	hour
HRC	hydrogen releasing compound
HSA	hollow-stem auger
HSDB	Hazardous Substance Data Bank
HTRW	hazardous, toxic, and radioactive waste
'I'	out of control, data rejected due to low recovery
IASPOW	Impact Area South of POW Training Facility
IATA	International Air Transport Authority
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively-coupled plasma
ICRP	International Commission on Radiological Protection
ICS	interference check sample
ID	inside diameter
IDL	instrument detection limit
IDLH	immediately dangerous to life or health
IDM	investigative-derived media
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IF	ingestion factor; inhalation factor
ILCR	incremental lifetime cancer risk
IMPA	isopropylmethyl phosphonic acid
IMR	Iron Mountain Road
in.	inch
Ing	ingestion
Inh	inhalation
IP	ionization potential
IPS	International Pipe Standard
IR	ingestion rate
IRDMIS	Installation Restoration Data Management Information System
IRIS	Integrated Risk Information Service
IRP	Installation Restoration Program
IS	internal standard
ISCP	Installation Spill Contingency Plan
IT	IT Corporation
ITEMS	IT Environmental Management System™
'J'	estimated concentration
JeB2	Jefferson gravelly fine sandy loam, 2 to 6 percent slopes, eroded
JeC2	Jefferson gravelly fine sandy loam, 6 to 10 percent slopes, eroded
JfB	Jefferson stony fine sandy loam, 0 to 10 percent slopes have strong slopes
JPA	Joint Powers Authority
K	conductivity
K_d	soil-water distribution coefficient
kg	kilogram
KeV	kilo electron volt
K_{oc}	organic carbon partioning coefficient
K_{ow}	octonal-water partition coefficient
$KMnO_4$	potassium permanganate
L	liter; Lewisite (dichloro-[2-chloroethyl]sulfide)
L/kg/day	liters per kilogram per day
l	liter
LAW	light anti-tank weapon
lb	pound
LBP	lead-based paint
LC	liquid chromatography
LCS	laboratory control sample
LC_{50}	lethal concentration for 50 percent population tested
LD_{50}	lethal dose for 50 percent population tested
LEL	lower explosive limit
LOAEL	lowest-observed-advserse-effects-level
LOEC	lowest-observable-effect-concentration
LRA	land redevelopment authority
LT	less than the certified reporting limit
LUC	land-use control
LUCAP	land-use control assurance plan
LUCIP	land-use control implementation plan
max	maximum
MB	method blank
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MCPA	4-chloro-2-methylphenoxyacetic acid
MCPP	2-(2-methyl-4-chlorophenoxy)propionic acid
MCS	media cleanup standard
MD	matrix duplicate
MDC	maximum detected concentration
MDCC	maximum detected constituent concentration
MDL	method detection limit
mg	milligrams
mg/kg	milligrams per kilogram
mg/kg/day	milligram per kilogram per day
mg/kgbw/day	milligrams per kilogram of body weight per day
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mh	inorganic silts, micaceous or diatomaceous fine, sandy or silt soils
MHz	megahertz
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
MeV	mega electron volt
min	minimum
MINICAMS	miniature continuous air monitoring system
ml	inorganic silts and very fine sands
mL	milliliter
mm	millimeter
MM	mounded material
MMBtu/hr	million Btu per hour
MNA	monitored natural attenuation
MnO_4-	permanganate ion
MOA	Memorandum of Agreement
MOGAS	motor vehicle gasoline
MOUT	Military Operations in Urban Terrain
MP	Military Police
MPA	methyl phosphonic acid
MPC	maximum permissible concentration
MPM	most probable munition
MQL	method quantitation limit
MR	molasses residue
MRL	method reporting limit
MS	matrix spike
mS/cm	millisiemens per centimeter
mS/m	millisiemens per meter
MSD	matrix spike duplicate
MTBE	methyl tertiary butyl ether
msl	mean sea level
MtD3	Montevallo shaly, silty clay loam, 10 to 40 percent slopes , severely eroded
mV	millivolts
MW	monitoring well
MWI&MP	Monitoring Well Installation and Management Plan
Na	sodium
NA	not applicable; not available
NAD	North American Datum
NAD83	North American Datum of 1983
$NaMnO_4$	sodium permanganate
NAVD88	North American Vertical Datum of 1988
NAS	National Academy of Sciences
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
ND	not detected
NE	no evidence; northeast
ne	not evaluated
NEW	net explosive weight

List of Abbreviations and Acronyms *(Continued)*

NFA	No Further Action
NG	National Guard
NGP	National Guardsperson
ng/L	nanograms per liter
NGVD	National Geodetic Vertical Datum
Ni	nickel
NIC	notice of intended change
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLM	National Library of Medicine
NO_3^-	nitrate
NOEC	no-observable-effect-concentration
NPDES	National Pollutant Discharge Elimination System
NPW	net present worth
No.	number
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed-adverse-effects-level
NR	not requested; not recorded; no risk
NRC	National Research Council
NRCC	National Research Council of Canada
NRHP	National Register of Historic Places
NRT	near real time
ns	nanosecond
N-S	north to south
NS	not surveyed
NSA	New South Associates, Inc.
nT	nanotesla
nT/m	nanoteslas per meter
NTU	nephelometric turbidity unit
nv	not validated
O_2	oxygen
O_3	ozone
O&G	oil and grease
O&M	operation and maintenance
OB/OD	open burning/open detonation
OD	outside diameter
OE	ordnance and explosives
oh	organic clays of medium to high plasticity
OH•	hydroxyl radical
ol	organic silts and organic silty clays of low plasticity
OP	organophosphorus
ORC	Oxygen Releasing Compound
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OVM-PID/FID	organic vapor meter-photoionization detector/flame ionization detector
OWS	oil/water separator
oz	ounce
PA	preliminary assessment
PAH	polynuclear aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
Parsons	Parsons Engineering Science, Inc.
Pb	lead
PBMS	performance-based measurement system
PC	permeability coefficient
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxins
PCDF	polychlorinated dibenzofurans
PCE	perchloroethene
PCP	pentachlorophenol
PDS	Personnel Decontamination Station
PEF	particulate emission factor
PEL	permissible exposure limit
PERA	preliminary ecological risk assessment
PERC	perchloroethene
PES	potential explosive site
Pest.	pesticides
PETN	pentaerythritoltetranitrate
PFT	portable flamethrower
PG	professional geologist
PID	photoionization detector
PkA	Philo and Stendal soils local alluvium, 0 to 2 percent slopes
PM	project manager
POC	point of contact
POL	petroleum, oils, and lubricants
POTW	publicly owned treatment works
POW	prisoner of war
PP	peristaltic pump; Proposed Plan
ppb	parts per billion
ppbv	parts per billion by volume
PPE	personal protective equipment
ppm	parts per million
PPMP	Print Plant Motor Pool
ppt	parts per thousand
PR	potential risk
PRA	preliminary risk assessment
PRG	preliminary remediation goal
PS	chloropicrin
PSSC	potential site-specific chemical
pt	peat or other highly organic silts
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAM	quality assurance manual
QAO	quality assurance officer
QAP	installation-wide quality assurance plan
QC	quality control
QST	QST Environmental, Inc.
qty	quantity
Qual	qualifier
R	rejected data; resample; retardation factor
R&A	relevant and appropriate
RA	remedial action
RAO	remedial action objective
RBC	risk-based concentration; red blood cell
RBRG	risk-based remedial goal
RCRA	Resource Conservation and Recovery Act
RCWM	Recovered Chemical Warfare Material
RD	remedial design
RDX	cyclotrimethylenetrinitramine
ReB3	Rarden silty clay loams
REG	regular field sample
REL	recommended exposure limit
RFA	request for analysis
RfC	reference concentration
RfD	reference dose
RGO	remedial goal option
RI	remedial investigation
RL	reporting limit
RME	reasonable maximum exposure
ROD	Record of Decision
RPD	relative percent difference
RR	range residue
RRF	relative response factor
RRSE	Relative Risk Site Evaluation
RSD	relative standard deviation
RTC	Recruiting Training Center
RTECS	Registry of Toxic Effects of Chemical Substances
RTK	real-time kinematic
RWIMR	Ranges West of Iron Mountain Road
SA	exposed skin surface area
SAD	South Atlantic Division
SAE	Society of Automotive Engineers
SAIC	Science Applications International Corporation
SAP	installation-wide sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
sc	clayey sands; sand-clay mixtures
Sch.	schedule
SCM	site conceptual model
SD	sediment
SDG	sample delivery group
SDWA	Safe Drinking Water Act
SDZ	safe distance zone; surface danger zone

SEMS	Southern Environmental Management & Specialties, Inc.
SF	cancer slope factor
SFSP	site-specific field sampling plan
SGF	standard grade fuels
Shaw	Shaw Environmental, Inc.
SHP	installation-wide safety and health plan
SI	site investigation
SINA	Special Interest Natural Area
SL	standing liquid
SLERA	screening-level ecological risk assessment
sm	silty sands; sand-silt mixtures
SM	Serratia marcescens
SMDP	Scientific Management Decision Point
s/n	signal-to-noise ratio
SO_4^{-2}	sulfate
SOD	soil oxidant demand
SOP	standard operating procedure
SOPQAM	U.S. EPA's *Standard Operating Procedure/Quality Assurance Manual*
sp	poorly graded sands; gravelly sands
SP	submersible pump
SPCC	system performance calibration compound
SPCS	State Plane Coordinate System
SPM	sample planning module
SQRT	screening quick reference tables
Sr-90	strontium-90
SRA	streamlined human health risk assessment
SRI	supplemental remedial investigation
SRM	standard reference material
Ss	stony rough land, sandstone series
SS	surface soil
SSC	site-specific chemical
SSHO	site safety and health officer
SSHP	site-specific safety and health plan
SSL	soil screening level
SSSL	site-specific screening level
SSSSL	site-specific soil screening level
STB	supertropical bleach
STC	source-term concentration
STD	standard deviation
STEL	short-term exposure limit
STL	Severn-Trent Laboratories
STOLS	Surface Towed Ordnance Locator System®
Std. units	standard units
SU	standard unit
SUXOS	senior UXO supervisor
SVOC	semivolatile organic compound
SW	surface water
SW-846	U.S. EPA's *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*
SWMU	solid waste management unit
SWPP	storm water pollution prevention plan
SZ	support zone
TAL	target analyte list
TAT	turn around time
TB	trip blank
TBC	to be considered
TCA	trichloroethane
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF	tetrachlorodibenzofurans
TCE	trichloroethene
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environment and Conservation
TDGCL	thiodiglycol
TDGCLA	thiodiglycol chloroacetic acid
TEA	triethylaluminum
Tetryl	trinitrophenylmethylnitramine
TERC	Total Environmental Restoration Contract
THI	target hazard index
TIC	tentatively identified compound
TLV	threshold limit value
TN	Tennessee
TNB	trinitrobenzene
TNT	trinitrotoluene
TOC	top of casing; total organic carbon
TPH	total petroleum hydrocarbons
TR	target cancer risk
TRADOC	U.S. Army Training and Doctrine Command
TRPH	total recoverable petroleum hydrocarbons
TRV	toxicity reference value
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TSS	total suspended solids
TWA	time-weighted average
UCL	upper confidence limit
UCR	upper certified range
'U'	not detected above reporting limit
UIC	underground injection control
UF	uncertainty factor
URF	unit risk factor
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEC	U.S. Army Environmental Center
USAEHA	U.S. Army Environmental Hygiene Agency
USACMLS	U.S. Army Chemical School
USAMPS	U.S. Army Military Police School
USATCES	U.S. Army Technical Center for Explosive Safety
USATEU	U.S. Army Technical Escort Unit
USATHAMA	U.S. Army Toxic and Hazardous Material Agency
USC	United States Code
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
UTL	upper tolerance level; upper tolerance limit
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Supervisor
UXOSO	UXO safety officer
V	vanadium
VC	vinyl chloride
VOA	volatile organic analyte
VOC	volatile organic compound
VOH	volatile organic hydrocarbon
VQlfr	validation qualifier
VQual	validation qualifier
VX	nerve agent (O-ethyl-S-[diisopropylaminoethyl]-methylphosphonothiolate)
WAC	Women's Army Corps
Weston	Roy F. Weston, Inc.
WP	installation-wide work plan
WRS	Wilcoxon rank sum
WS	watershed
WSA	Watershed Screening Assessment
WWI	World War I
WWII	World War II
XRF	x-ray fluorescence
yd^3	cubic yards